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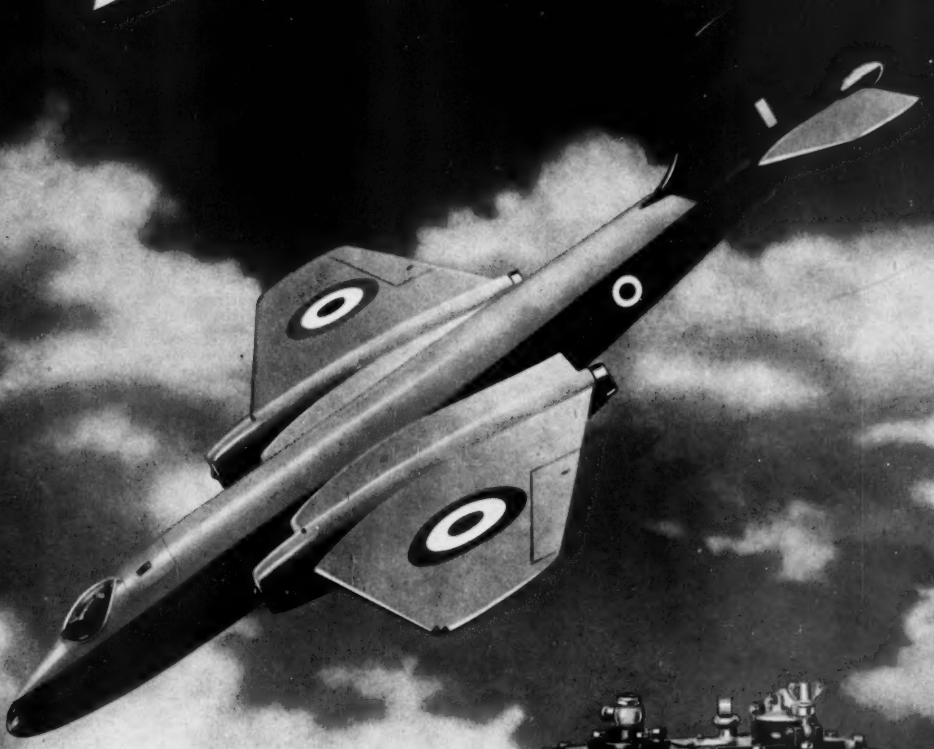

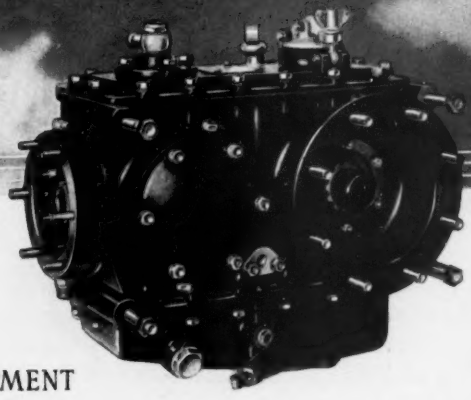

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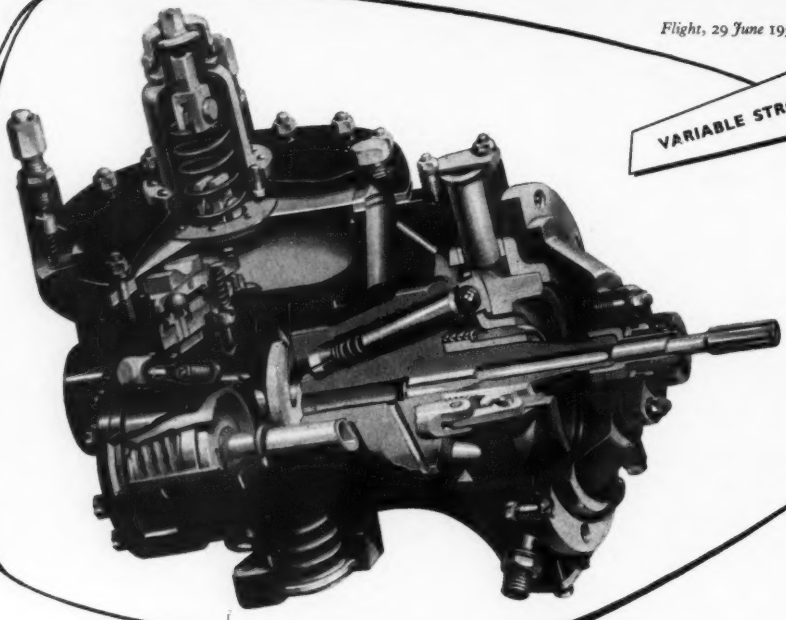
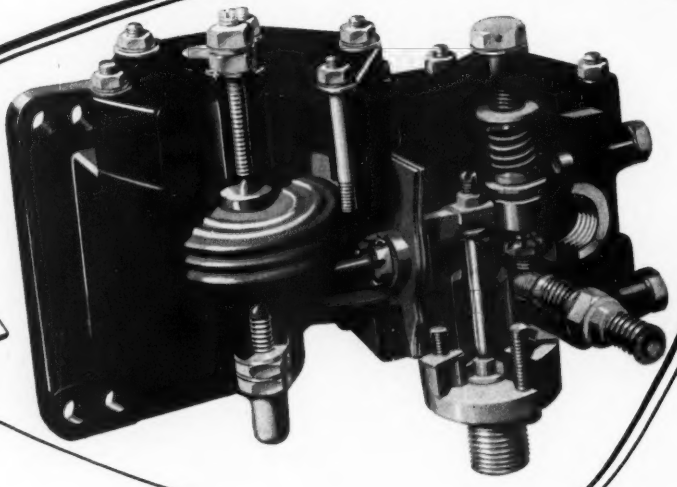


BAROMETRIC CONTROL



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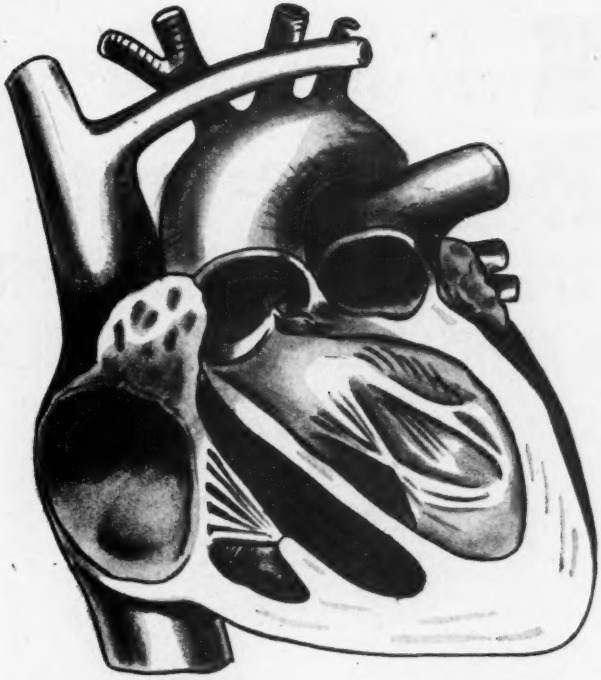

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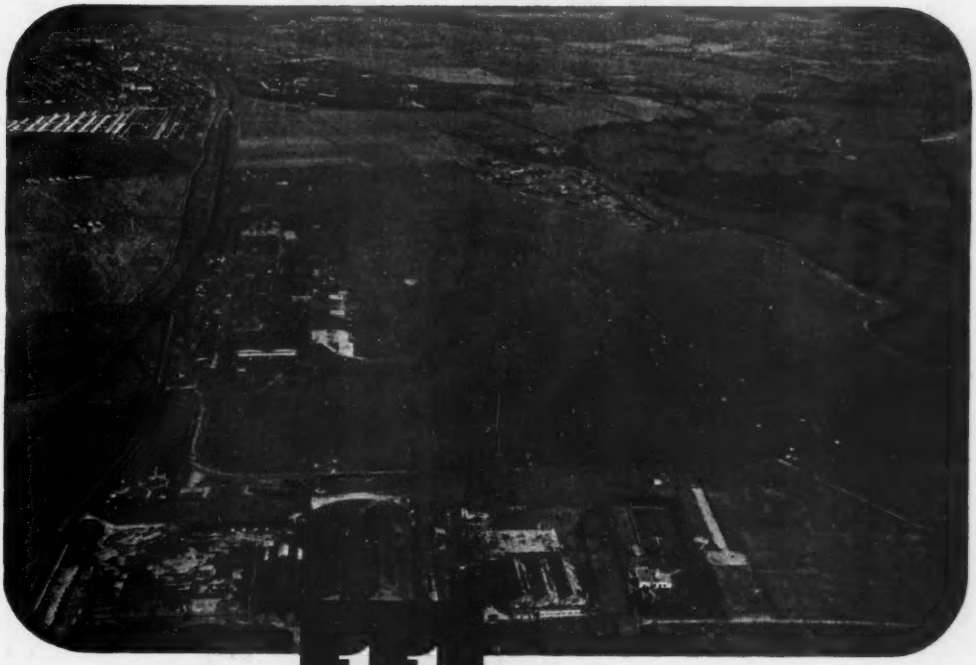

11

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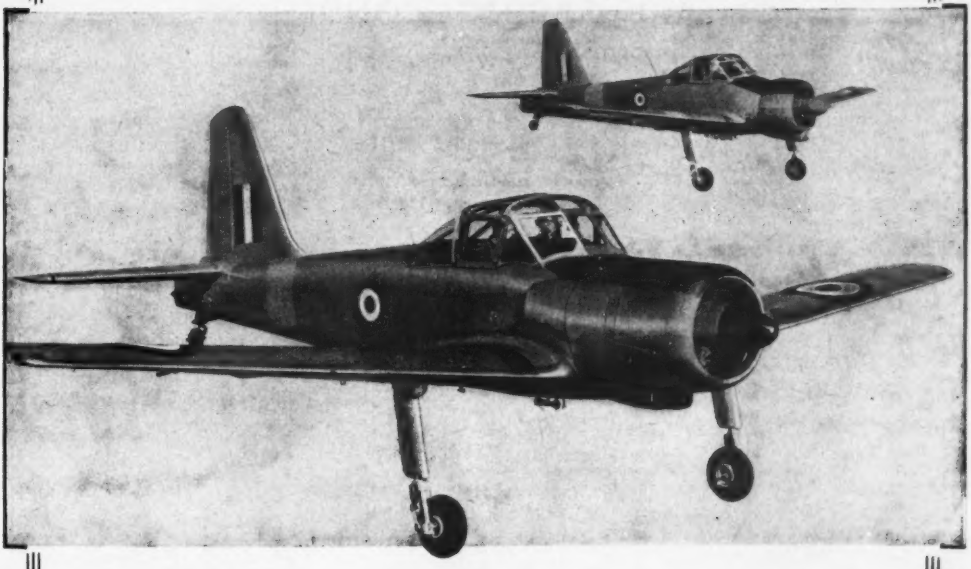

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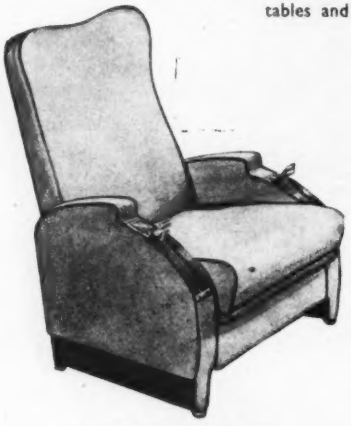

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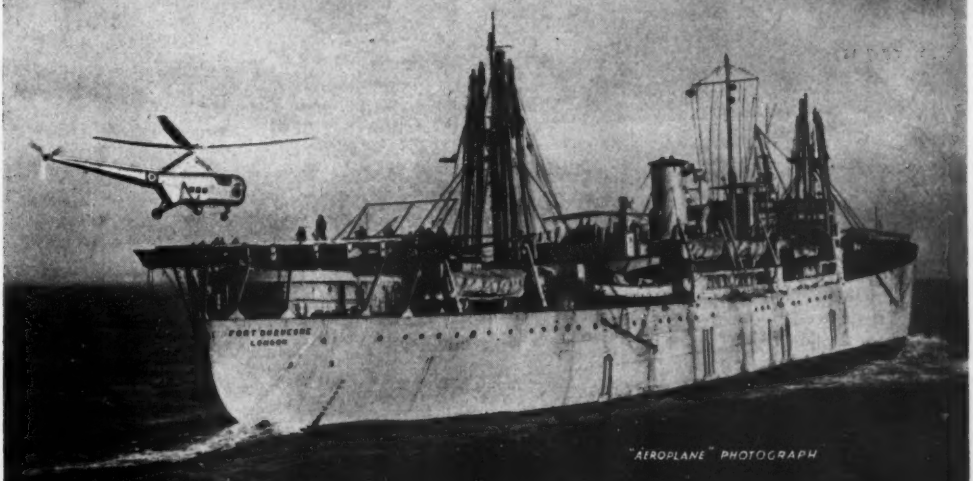

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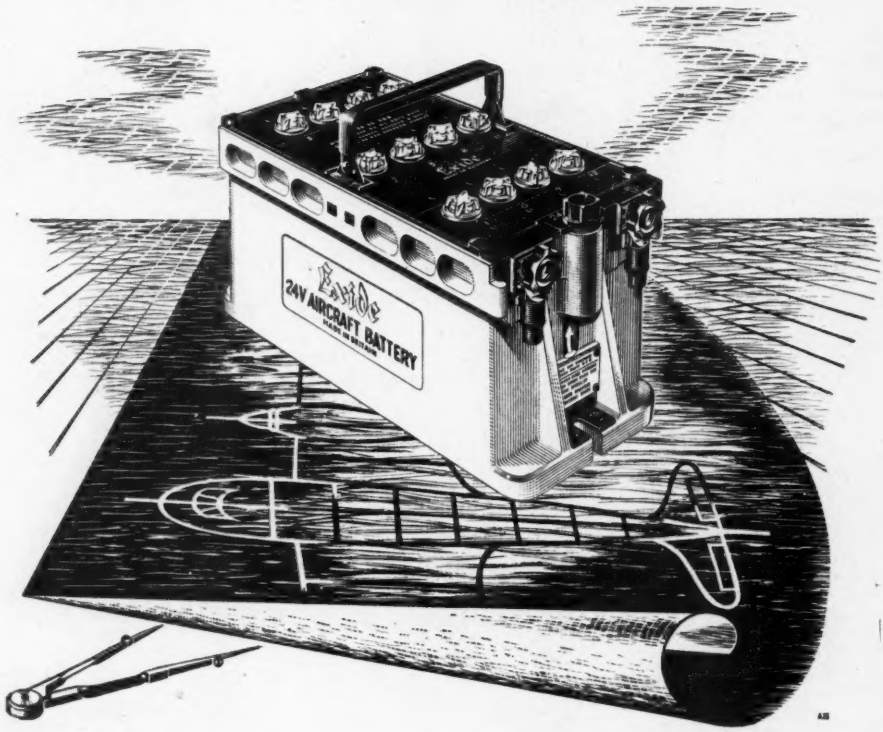

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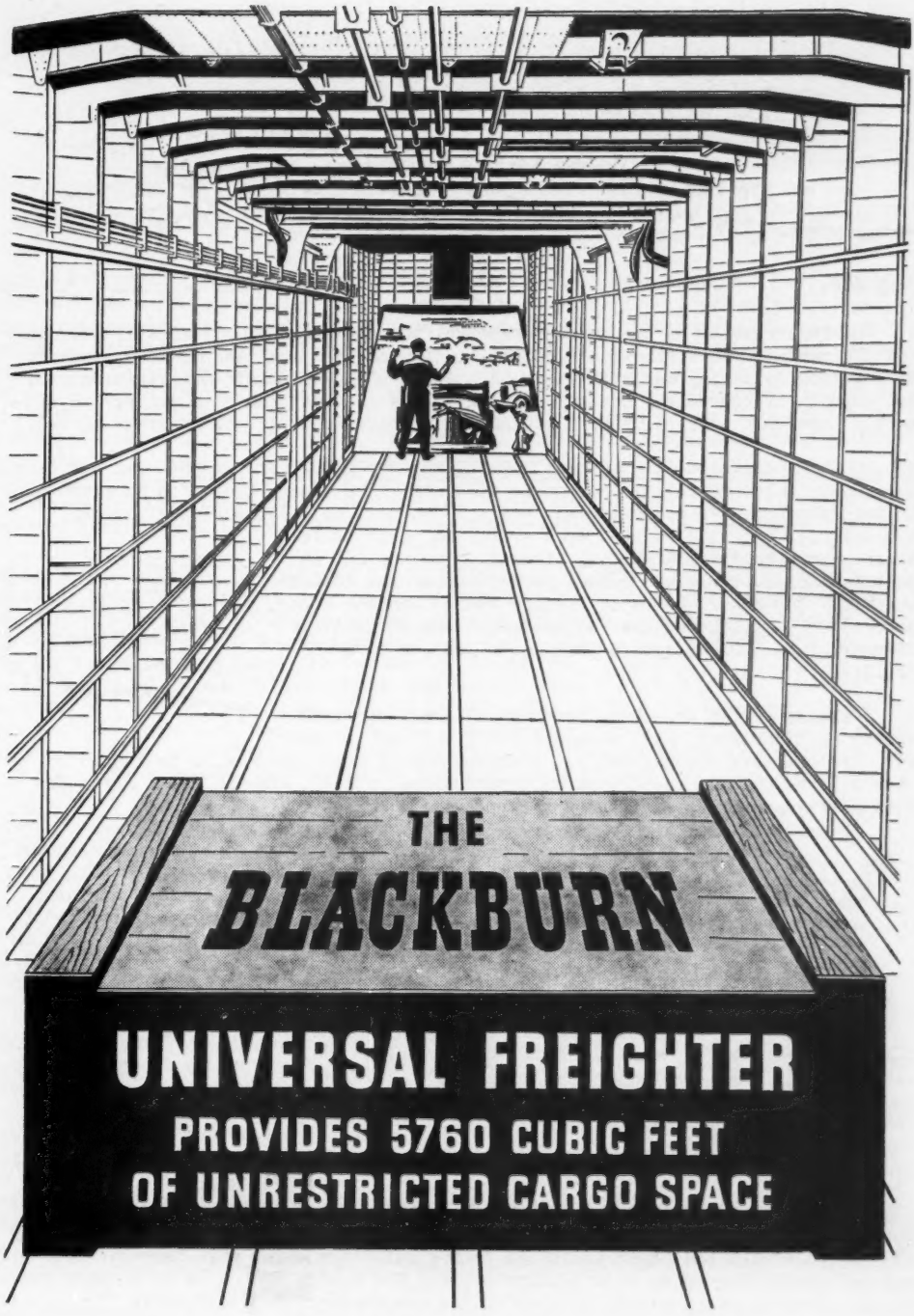
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UNITED AIRGRAM

UNITED AIRCRAFT EXPORT CORPORATION

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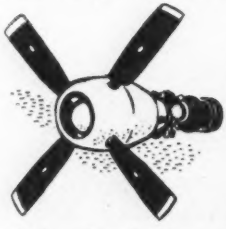
The requirements of the Korean campaign, the expansion of our military forces and the needs of both domestic and foreign airlines are such that United Aircraft Corporation is taking decisive steps to keep up with the demand for its products. But conditions beyond our control may cause lags now and then in service. We sincerely hope that there will be a minimum of inconvenience for our friends abroad.

$20,000,000 EXPANSION PLAN FOR PRATT & WHITNEY AND HAMILTON STANDARD- Two new plants, now under construction will add more than a million square feet of production area to United Aircraft's present plant space. One will be located at North Haven, Connecticut, and will be used as a satellite plant to feed engine parts to Pratt & Whitney Aircraft's main plant at East Hartford, to achieve volume production of gas turbine engines. The other, to be at Bradley Field, Windsor Locks, Connecticut, will house the entire operations of Hamilton Standard in a 500,000 square-foot, one floor, modern building.

Release of the space now occupied by Hamilton Standard in East Hartford, will permit Pratt & Whitney to expand its quarters substantially. Construction of both plants will be rushed so that they will be able to receive production tooling by fall, and the labor force for both divisions will be increased by approximately 10,000.



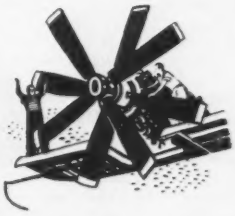
The added space will enable Pratt & Whitney to produce, in addition to the two centrifugal flow jet engines it now makes, two new axial flow, high power jet turbine engines. One is the J-57, a highly advanced type, the performance of which is under military security restrictions. The other is the T-34, the most powerful propeller turbine engine now flying in the United States or England. Flight tested since last summer, it has been chosen to power the Air Force's giant transport plane, the Douglas C-124. Completion of Hamilton Standard's new plant will make possible even greater production of that Division's steel and dural propeller blades as well as cockpit refrigeration units and aircraft accessories. No appreciable loss of production is anticipated because of the transfers.

SIKORSKY AIRCRAFT DIVISION ALSO EXPANDING PLANT - To meet substantial increases in orders for its military helicopters, the Sikorsky Aircraft Division has begun additions to its buildings which will increase its present production space to approximately 500,000 square feet. It is already the world's largest plant solely devoted to the manufacture of hilicopters.

SIKORSKY S-55 GOES TO WAR-The ten-place Sikorsky H-19 (USAF version of S-55) recently went into action for the first time in Korea. The craft flew two missions and

evacuated 15 men. The ease with which the craft can be disassembled for shipment, then reassembled, was shown when it was flown to Japan aboard a Douglas C-124. The H-19 will be placed in service with the Air Rescue Services this year and will undergo tests under actual operational conditions by the United States Air Force Air Materiel Command and the Air Proving Ground. Meanwhile the smaller H-5 has more than demonstrated its worth by rescuing some 1700 men from front line positions or from behind enemy lines in Korea. In addition to increased military orders for the H-19, and the four-place H-18, Sikorsky Aircraft was recently named winner of a Marine Corps design competition for new type assault helicopter with far-reaching possibilities.

HAMILTON STANDARD PREPARES FOR THE FUTURE - In the few years since V-J Day, Hamilton Standard has so developed its line of propellers that more than 90% of all U.S. Transports either are, or soon will be equipped with the Division's Hydromatic. In addition, Hamilton Standard has pioneered the basic concept of the supersonic propeller and is designing two types under U. S. Navy and Air Force sponsorship. Its work on development of propellers for propeller-turbine engines has also moved rapidly ahead with extensive testing of two four-bladed models and also an eight-bladed dual-rotation type. The division has broadened its activities to include other aircraft products. For example, its air-cycle refrigeration units have been ordered for three important U.S. jet fighters—the North American F-86D Sabre, the Lockheed F-94C all-weather interceptor, and the Chance Vought F7U Cutlass.



HAMILTON STANDARD BUILDS HUGE TURBINE PROPELLER - A 19-foot aircraft propeller, largest ever built by Hamilton Standard for turbine engines, is undergoing tests by the USAF Air Materiel Command at Wright-Patterson Air Force Base. The big propeller was developed for the Air Force for power plants of over 5,000 horsepower and has a double purpose. It can be used on the highest power piston engines now being considered and also the so-called "medium horsepower" turbines. When used in conjunction with another 19-foot propeller, with connecting mechanism, it can serve as an eight-bladed, dual-rotation model, capable of handling much greater power.

The new propeller is the third of Hamilton Standard's line of specially designed turbine propellers — called Turbo-Hydromatics — to reach the stage of Air Force or Navy testing after extensive endurance testing by the manufacturer. Two others are being tested by the Navy, a smaller four-bladed propeller, now in the flight stage, and a dual-rotation eight-bladed version. The series incorporates experience gained in more than 2,600 hours of flight and ground testing of Hamilton Standard propellers on turbine engines in the past five years.

The Turbo-Hydromatic uses an electronic control to regulate hydraulic pitch-changing mechanisms which adjust the blade angle in flight. On the ground, the pilot takes over direct control of the propeller blade angle. This permits control of the airplane's taxiing speed, forward and backwards by changing the amount and direction of thrust. In contrast to the size of the new Turbo-Hydromatic are the two 3½-pound pumps, each about the size of an inkwell, used to change rapidly the pitch of the big, hollow steel blades. Requiring a total of 15 horsepower from the engine shaft to drive them the pumps are used together only for rapid pitch adjustment in the event of sudden power changes, and for feathering and reversing. Under normal conditions, only one pump is used for propeller operation.

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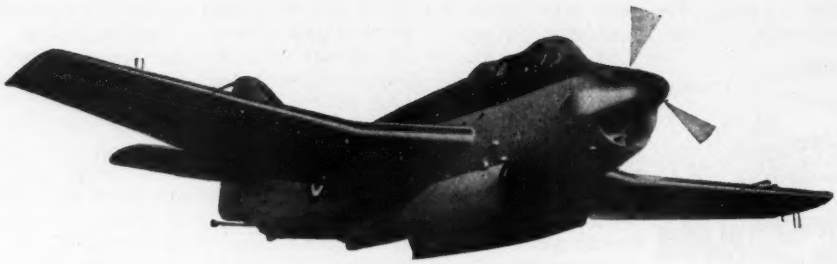

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Teams Against the Submarine

IT is hardly surprising that much confused thought should persist concerning anti-submarine aircraft and their applications. Security is especially stringent in these matters, particularly as affecting weapons, and the diversity of aircraft now being adapted or developed for anti-submarine duties naturally adds to the confusion.

It must first be appreciated that several classes of shipborne and shore-based aircraft now appear to be necessary to counter the modern submarine in its various forms and operational rôles. For the protection of a fleet or a convoy at sea the primary requirement is for deck-landing machines capable of detecting and destroying submarines at moderate range. To this end the Americans and ourselves have sought to evolve a "single-packet" design capable of functioning impartially (with appropriate equipment) in the search or strike rôle. It is no longer a secret that the newest U.S. Naval type built to this formula—the Grumman Guardian—will not normally operate independently; instead, two Guardians—a "hunter" and a "killer"—will work as a team, the one being more or less ineffective without the other. At present the Royal Navy has no counterpart of the Guardian, which, in essence, is a large single-engined multi-seater monoplane capable of carrying heavy internal and external loads. The AF-2W "hunter" variant provides for a four-man crew (pilot and co-pilot in the forward cockpit, and two radar operators in the fuselage) and its bulky radar is useful not only for detecting submarines, but for providing early warning for the fleet. In a purely anti-submarine capacity this radar is said to perform most effectively below 5,000ft, where it can pick up a schnorkel, though the degree of success in this is dependent upon the skill and experience of the operator.

The AF-2S "killer" carries an offensive load of some 8,000 lb, in addition to a relatively simple radar installation and a searchlight.

Contemporary with, though by no means a counterpart of, the Guardian, is our own Fairey Firefly Mk 7, an interim adaptation of the fighter/reconnaissance Firefly, exclusively intended for anti-submarine search and strike pending the introduction of the Fairey 17 (now named Gannet)—a type more directly comparable with the Guardian but turbine-powered, and, like the American machine, having provision for heavy and bulky loads for the fulfilment of its search and/or strike missions. To date there has been no official intimation that the Gannets will operate in pairs, as do the Guardians, and there appears to have been some hesitancy in deciding on the final crew-layout. In this connection, it may be observed that the side-by-side arrangement, with a radar operator in first-hand contact with the pilot, has much to commend it, though there is no provision for this in the Gannet.

The divergence of thought in the design of carrier-borne anti-submarine aircraft is illustrated by the new Grumman XA2F-1, with two Wright Cyclone piston engines, and the French Bréguet 96, having an Armstrong Siddeley Mamba turboprop and a Rolls-Royce Nene turbojet. The Bréguet, it must be observed, is of less specialized character.

Effective as is the equipment now available for search, an occasional submarine will inevitably elude the hunter/killer packs and close in on its quarry. To deal with these menaces, helicopters—operated from Naval or merchant ships—make a strong claim, and it is known that the Royal Navy is deeply interested in this application of rotary-wing aircraft. The latest manifestation of this interest is the expeditious ordering of sea-trials with the new Westland-Sikorsky S-55, some impressions of which appear in this issue.

This, then, is the picture as now presented on the ship-borne side of development; but it is self-evident that for Commonwealth defence and for the discharge of our international commitments we must have long-range, shore-based machines to deal with any submarines operating in areas where fleet protection is not guaranteed. It is gratifying to record that the Avro Shackleton landplane is already in R.A.F. service, but adoption of a new flying-boat, such as that proposed in our issue of May 18th, is still awaited.

It must be recognized that without the short-range ship-borne helicopter and the long-range flying-boat our Naval/R.A.F. anti-submarine force must remain seriously unbalanced.

WEATHER DEFEATS FESTIVAL

THE King's Cup Air Race has been flown nineteen times, and has suffered in greater or lesser degree from Britain's weather; but never until last Saturday, when the twentieth contest was to have been run, has it had to be postponed until some indefinite date. It was doubly unfortunate that the other speed events to have been flown on the same day, the whole constituting the Festival of Britain 1951 National Air Races, suffered a similar fate. A proportion of the substantial financial support made available by the Kemsley Flying Trust must, it seems, be written off as a loss, in spite of the fact that nearly 20,000 spectators (though not all paying) arrived hopefully at Hatfield Aerodrome.

Wise as they were in the circumstances, the series of time-postponements and the eventual decision to abandon the day's racing naturally caused the deepest disappointment, both among spectators and the countless others, from competitors to groundsmen, who had put in many days of strenuous work preparing for the great day. The organization was on a prodigious scale, the Royal Aero Club, the de Havilland Aircraft Co., and a score of "sub-contractors," voluntary and otherwise, having planned and installed down to the minutest detail. Many felt that even the S.B.A.C., with its vast Farnborough Show organization, had been rivalled if not beaten. Certainly the enclosures, with their marquees and flower-beds and scores of loudspeakers, appeared impressive even in Saturday's grey meteorological pall; in sunlight they would have looked magnificent.

The breakfast-time B.B.C. weather forecasts had been hopeful, and even the mid-morning met. at Hatfield ("6/8ths to 8/8ths low stratus at 1,000-1,500ft; drizzle will cease") had echoed some optimism. The R.Aux.A.F. Cooper Trophy Race having been cancelled a week earlier for Service reasons, the first event in the programme was to have been the start, at 1.30 p.m., of the King's Cup and its concurrent weight-category contests. Shortly after noon, however, when the ceiling grew even darker and lower, a new programme order was announced, to begin at 2.30 p.m. The various flying display items were to come first, the Jubilee Trophy Race—the three-in-one high-speed event over the 35-mile "short" circuit—and the King's Cup Race being flown after 4 p.m., by which time, it was hoped, things might be better.

Principal mitigating factor in a day of disappointments was the gracious presence of Their Royal Highnesses the Princesses Elizabeth and Margaret, seen with de Havilland's John Cunningham and Lord Brabazon. Princess Margaret inspected the Comet.

In the event, even the new running-order was interfered with at the outset, two aero-towed sailplanes which were to have performed aerobatics failing to get through from Redhill, though they had made a valiant try. Members of the Society of Model Aeronautical Engineers, however, filled the gap with some demonstrations of control-line, free and radio-controlled models, and then C.T.D. Hosegood took the air with a Bristol 171 Mk 3 Sycamore Helicopter—just the thing for a demonstration in one-mile visibility, for it was able to go through most of its repertoire in, so to speak, the vertical plane between the floor and the ceiling, directly in front of the Royal Enclosure.

By this time Their Royal Highnesses Princess Elizabeth and Princess Margaret had arrived. Princess Margaret, especially, must have been disappointed at the subsequent abandonment of racing, for she had entered two aircraft—the veteran Hawker Hart "MR" for the King's Cup and the Hurricane 2c for the Jubilee Trophy, both to have been flown by G/C. Peter Townsend. Nevertheless both the royal visitors stayed on, and both appeared thoroughly to enjoy the flying display, handicapped as it was by the prevailing conditions; both, too, displayed a keen and knowledgeable interest in everything they saw.

The dashing Prince Cantacuzene—a romantic figure with a highly practical turn of mind and an aerobatic pilot of the first rank.

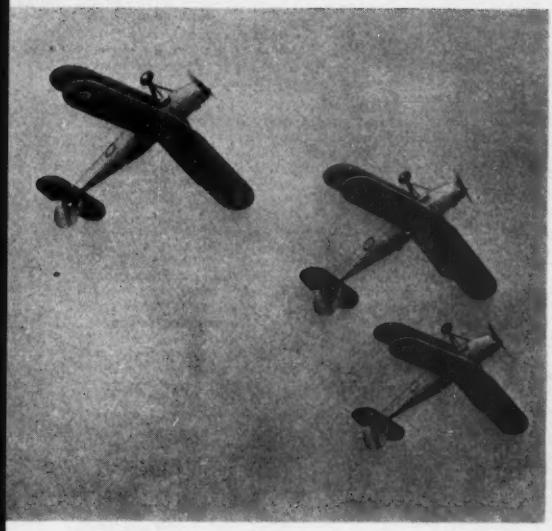
Hosegood having rotated his way upwards, downwards, sideways, backwards —at about 30ft—and occasionally forwards, Peter Bugge (D.H. experimental test pilot) took off in the bogie-wheeled Comet G-ALYP, the third of the series and to be first of the B.O.A.C. fleet proper. He contented himself with fly-pasts at moderate and flaps-down speeds, the white upper surfaces of the graceful aircraft, when it turned, looking almost luminous against the leaden sky. At one point, positioning for another pass, he reported over the R/T. that he had found himself in cloud at 400ft.

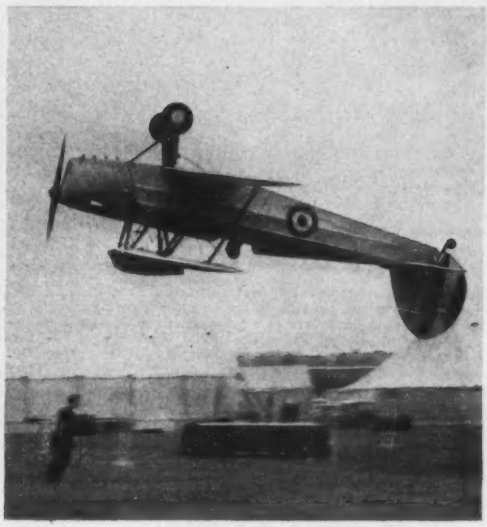
Next came a contribution by the famous Patrouille d'Etampes of the French Air Force. Many of those present, inveterate demonstration-watchers, had seen them on numerous occasions before, but this is a turn that never palls. Again, it was an ideal one for such a day, for even on the few occasions when the trio of Stampe biplanes is momentarily absent from the central arena their C.O., Comdt. Perrier, is sailing past, usually inverted at under 100ft. When the trio climbed vertically to 500ft or so for their beautiful simultaneous stall turn to starboard (executed without breaking their tight formation) they were within the cloud-fringes as they cartwheeled.

To ask any low-altitude aerobatic artist to follow the Patrouille in a programme is asking a great deal; but Prince "Buzz" Cantacuzene, having been asked, took his 18-year-old Bücker biplane and succeeded brilliantly, for his act is one in which the element of surprise is outstanding; moreover, he is new to this country. Thus, he takes off from the runway and literally within a few seconds of unsticking throws his aircraft on to its back. Then follows a series of low fly-pasts, some inverted, some right-way-up, with the 160 h.p. Siemens Sh.14A radial purring contentedly; and always, when one least expects it, comes some instantaneous roll, or variation on a roll. Most startling of all, perhaps, and commenced from normal altitude, is a lightning one-and-a-half flick, after which he continues inverted. Another superb piece of nonsense is a vertical climb which gradually peters out until the biplane is literally hanging stationary, then gently drops its nose round and down—the slowest stall turn we have ever seen.

Like a dramatic critic wondering whether he should give away a surprise ending, one hesitates as to whether it is fair to mention the Rumanian's *tour de force*. Yet, since visitors to future displays may miss it unless forewarned—as, indeed, some did on Saturday —it should be said that it does not occur until the Bücker is on its final approach, at the end of the demonstration. Just as the wheels are about to touch, Cantacuzene gives a burst of engine, gains a few feet of height, then whips over in a sudden flick roll; so far as altitude is concerned, the whole thing could be done under the roof of a decent-sized hangar.

To the lower near edge of the rudder of the well-worn old Bücker had been added a sheet of light alloy to give extra area, and on Saturday it had been bent in taxying; some of the distortion was passed on to the rudder itself. Somebody remarked on this before the demonstration. "Yes, I know," said Prince Cantacuzene, "I do not like it all. It is very bad I think." After





Illustrated by "Flight" Photographs

AIR RACES

At the head of the page are a trio of the French Patrouille d'Etampes and the unit's lone-wolf leader, in the person of Commandant Perrier (note retreating bystander). Immediately above is the only competing aircraft to take off—the Vampire N.F.10, John Cunningham up, which made a "met." flight. (Right) R. R. Paine, G/C. the Hon. Max Aitken, A. Cdre. A. V. Harvey, F. Dunkerley and Major Uniacke. (Below) King's Cup competitors.

This picture, taken at Hatfield on Saturday, apparently shows the Brabazon making a low approach. Actually it is of a magnificent 10ft-span model, flying (on a control line) between the camera and the spectators. Four miniature diesel engines provide the power; W. P. Holland was the constructor.

WEATHER DEFEATS FESTIVAL AIR RACES . . .

saying which he took off, and performed as aforesaid. . . .

There was still no sign of the weather relenting; the name DUNLOP, in big letters of red fluorescent ink on the turning-point pylon, glowed like neon against the murky sky. John Cunningham went off in the Vampire N.F.10 to prospect the Jubilee Trophy course, and presently returned to announce it as quite impossible, with visibility of little more than a mile.

If this circuit was unusable for the high-speed aircraft, the long course (from the distant points of which gloomy reports were being received) was equally impossible for the slower metal in the King's Cup, for the radio masts at Brookmans Park, North Weald and Brentwood lay only a mile or two on either side of the track. Moreover, particularly on the Southend-Cambridge leg, there was a deficiency of landmarks that would have been particularly trying for pilots of aircraft with poor forward visibility.

The race stewards thereupon went into final consultation, while F/O. Murphy in a Meteor 8 of No. 66 Squadron kept the crowd entertained with such aerobatics as could be performed over a wide speed range in horizontal directions. Especially praiseworthy were his eight-point rolls and a sequence of slow rolls so executed as to describe an arc round the airfield. To say that Murphy cut a dash is literally true, for many of his evolutions were traced by condensation trails or marked (as Charles Gardner put it) by the Meteor's precipitation of its own private cloud. We doubt if this performance would have proved any more entertaining had the sky been unsullied and visibility unlimited; it was at once a masterpiece of flying and proof positive that the Meteor is not (as it may appear) a fearsome, intractable projectile, but, with the right man at the controls, a docile mount for low- and medium-speed demonstration flying in a confined space.

The stewards' decision was the inevitable one (though the competitors, waiting patiently in the briefing room, were the last to learn it—from spectators outside the windows). "The races will not take place today but will not necessarily be abandoned," said the official announcement. "The decision rests with the Racing Committee . . . it is unlikely they will be held this year."

Later, it was hinted unofficially that there might be a possibility of grafting some or all of the National Races on to events yet to be held this summer.

Many wondered why the meeting could not have been postponed until the following day—which, as it turned out, would have been meteorologically ideal. The answer seems to be that to indulge in air racing on an English Sunday is wicked, especially if you have paid for admission on the Saturday.

So that was that. And while Dumbo Willans, Johnny Ralling and Chuck Thompson—who were to have competed in a parachute spot-landing competition—wing-walked on three Panshanger Tiger Moths, the spectators prepared to depart homewards, disappointed in their main objective, but in the main grateful to the display pilots who had defied the weather to entertain them.

NO-RACE POSTSCRIPTS

As we go to press it is learned that the R.Ae.C. race committee was to meet on Tuesday and make recommendations to a meeting of the main committee on Wednesday. An announcement was expected on Thursday.

* * *

The programme disclosed that the Ghost turbojet in the de Havilland Venom F.B.1, to be flown by John Derry, was a Mk 3.

* * *

Hawker's redoubtable "MR"—the Kestrel III-engined Hart day bomber entered by H.R.H. Princess Margaret—appeared as a single-seater. So cleanly was the rear cockpit faired in that only the projecting lips of the gun-ring fairing bespoke the Hart's original *bipasto* status. Surprisingly, considering the extent of the cleaning up, was the retention of the access step on the port side.

* * *

Competitors were grateful for the ministrations of the fuel and oil companies—Shell-Mex and B.P., Esso, and Wakefields—who provided, besides personal refreshment, transport on and around the airfield. Docker Brothers, together with Cellon, Ltd., were most helpful, also, in number-painting and allied directions.

* * *

Although no one can say how the speeds of the aircraft would, in fact, have worked out in the Races, the handicap times give a very interesting indication of what was expected of them. Several are known quantities in which no change had apparently been made since previous races, and therefore their speeds may be taken as an approximate datum. For example, Tony Cole (Comper Swift) would probably not have bettered his 131 m.p.h. average in the Goodyear Race, and D. C. Jemmett in his Hawk Trainer would again probably have flown at 129-130 m.p.h. Jimmie Rush in the Falcon Six averaged a little over 170 m.p.h. in the Goodyear Race, and with all his cunning would probably not have been more than a mile or two faster in the King's Cup. Taking Cole's Comper Swift at 131 m.p.h. as a datum, some approximate equivalent handicap speeds are given below.

ESTIMATED REQUIRED SPEEDS

(Based on assumption that Cole's Comper Swift could average 131 m.p.h.)

Pilot	Aircraft	H'cap m s	Estimated Req. Speed m.p.h.
W. L. James	Chilton D.W.1 (Carden Ford)	00.00	102.8
R. E. Gillman	Avian 4m (Gipsy II)	00.00	102.8
E. S. Hughes	Moth (Gipsy II)	01.45	104.5
P. M. A. Hull	Moth (Gipsy I)	03.10	106.3
Mrs. Y. M. Grace	Taylorcraft Plus D (Cirrus Minor I)	03.35	106.8
D. J. P. Broomfield	Autocrat (Cirrus Minor II)	07.20	111.1
D. G. S. Cotter	Autocrat (Cirrus Minor II)	09.15	113.6
N. F. Duke	Hawker Tomtit (Mongoose 3c)	10.00	114.3
J. Cooper	Moth Minor (Gipsy Minor)	10.00	114.3
P. Q. Reiss	Hornet Moth (Gipsy Major I)	12.10	117.3
R. W. Bates	Hornet Moth (Gipsy Major I)	12.10	117.3
C. Dawson	Hawk Trainer III (Gipsy Major I)	14.15	120.3
E. W. Westbrook	Messenger 4a (Gipsy Major 1d)	14.55	121.2
D. F. Ogilvy	Hawk Trainer III (Gipsy Major I)	14.55	121.2
C. A. Nepean Bishop	Hawk Trainer III (Gipsy Major I)	16.55	123.9
K. M. Freeman	Hawk Trainer III (Gipsy Major I)	16.55	123.9
J. K. Brown	Moth Minor Coupé (Gipsy Minor)	17.30	125.1
R. Matthews-Naper	Messenger 2a (Cirrus Major III)	18.10	126.2
T. W. Hayhow	Aiglet (Gipsy Major)	18.30	126.5
W. L. Foster	Hawk Trainer III (Gipsy Major I)	18.45	127.0
D. C. Jemmett	Hawk Trainer III (Gipsy Major Ic)	19.05	127.5
Miss E. L. Curtis	Wicko G.M.1 (Gipsy Major I)	20.20	129.3
W. P. Bowles	Messenger 2a (Cirrus Major III)	20.35	129.7
J. T. Basnett	Hawk Trainer III (Gipsy Major I)	20.35	129.7
A. L. Cole	Comper Swift (Pobjoy R)	21.10	131.0
A. S. Butler	Leopard Moth (Gipsy Major I)	21.25	131.5
R. W. Jamieson	Leopard Moth (Gipsy Major 1-3)	22.00	133.1
J. H. Ashton	Hawk Trainer III (Gipsy Major I)	22.15	133.2
G. F. Bullen	Miles Whitney Straight (Gipsy Major I)	23.05	134.6
M. Sharp	Chipmunk (Gipsy Major 10-1)	24.45	137.6
P. Raymond	Hawk Trainer III (Gipsy Major I)	25.00	137.8
W. P. I. Fillingham	Chipmunk (Gipsy Major 10-2)	25.30	139.0
T. R. Hilton	Chipmunk (Gipsy Major 10-1)	25.45	139.2
M. A. Smith	Gemini Ia (2 Cirrus Minor II)	26.30	141.0
A. E. Coltman	Hawk Major (Gipsy Major I)	26.45	141.2
W. T. Franklin	Gemini Ia (2 Cirrus Minor II)	28.10	144.3
D. J. Bennett	Proctor V (Gipsy Queen II)	28.10	144.3
W. J. Twitchell	Proctor V (Gipsy Queen II)	28.25	144.6
H.R.H. Prince Alexander of Yugoslavia	Proctor III (Gipsy Queen II)	28.50	145.6
W. I. Lashbrooke	Proctor III (Gipsy Queen II)	29.45	147.7
H. A. Purvis	Proctor V (Gipsy Queen II)	30.15	148.7
Mrs. Z. Irwin	Proctor V (Gipsy Queen II)	30.15	148.7
J. H. Sauvage	Proctor I (Gipsy Queen II)	30.40	149.3
D. F. Little	Vega Gull (Gipsy Six II)	32.25	153.3
H. Wood	Proctor I (Gipsy Queen II)	33.15	155.2
K. C. Millican	Proctor III (Gipsy Queen III)	34.25	158.2
G. Marler	Falcon Six (Gipsy Six If)	36.30	160.9
J. Rush	Falcon Six (Gipsy Six I)	39.00	170.3
F. Dunkerley	Gemini Ia (2 Cirrus Minor II)	39.30	171.8
Hon. Max Aitken	Gemini IIIb (2 Gipsy Major 10-1)	39.50	172.8
P. Townsend	Harz (Kestrel 3)	45.20	190.8
R. R. Paine	Hawk Speed Six (Gipsy Six If)	45.35	191.6
H. E. Scrope	Mew Gull (Gipsy Six II)	54.20	230.0

FROM ALL QUARTERS

Soviet Aircraft Active

IN Germany, Russian aircraft have again been busy exercising in the Brandenburg-Dallgow-Elsgrund area. Early on the morning of June 15th, for instance, three of the new twin-jet bombers were observed, escorted by six Mig-15 fighters. Thereafter every hour came formations of jet bombers from various directions, and at all heights. A correspondent claims to have identified three variants of the bomber: (1) the standard machine, as illustrated in *Flight* of May 25th; (2) a version without transparent nose and with no radome; (3) similar to (2) but with radome. In Korea, Yak-9 fighter-bombers and Il-2 ground-attack aircraft have been active, in addition to Mig-15s.

L. G. Frise to Develop Percival Helicopters

A HELICOPTER-DESIGN division of Percival Aircraft, Ltd., is shortly to be created. This news is contained in an announcement that Mr. L. G. Frise, B.Sc., F.R.Ae.S., A.F.I.Ae.S. —under whose control it will come —has been appointed technical director of the company. Leslie Frise has been chief engineer and chief designer for nearly three years. Previously, and from soon after the first world war, when he served in the R.N.A.S., he was with the Bristol Aeroplane Company, for whom he designed many famous types. The 1930 Bulldog, which became the standard fighter of the R.A.F., was his, as was the *Britain First* (1934), which was developed into the famous Blenheim; detail design of the hydraulics, retractable undercarriage and flap gear were all from his drawing-board. Other history-making Bristol types to his credit included the Beaufort, Beaufighter, Bombay, Freighter and Brigand, and he was responsible for the original conception of the Brabazon design.

Mr. L. G. Frise

His many patents include the Frise aileron (for which he was awarded a Wakefield Gold Medal by the R.Ae.S.) and the all-electric cannon turret.

On joining the Percival concern, he continued the development of the Prince into its present versatile status, and he has also played an important part in the success of the P.56 (now named the Provost) which recently won the competition for a new R.A.F. basic trainer.

Orenda Details

AS recorded on page 756, the Avro Canada CF-100 long-range, all-weather fighter, powered by two Avro Canada Orenda turbojets, has made its first flight. Of particular interest, therefore, are the new details of the Orenda made known by Mr. Douglas Knowles, chief development engineer of Avro Canada's gas turbine division, when he addressed the American Society of Mechanical Engineers in Toronto recently.

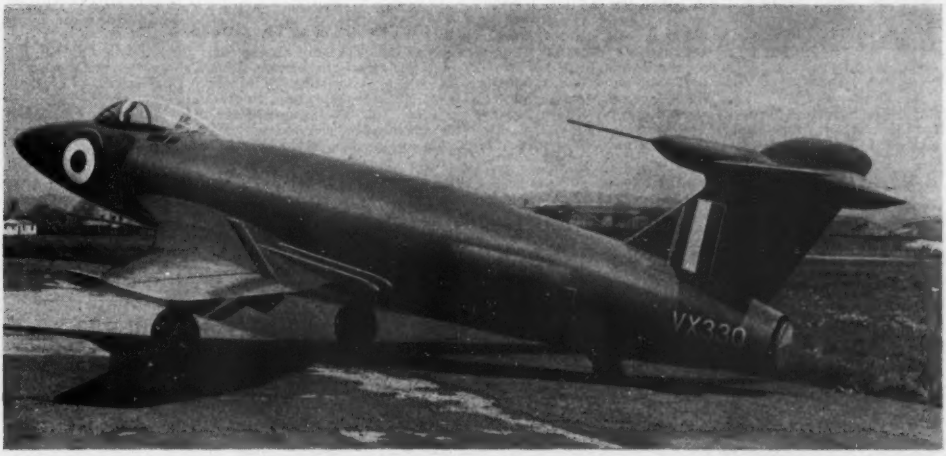
During the 4½ years of development behind the Orenda, the engine has undergone 5,000 hr of bench-testing and 150 hr of flying. Designed primarily to power the CF-100, it delivers a rated thrust in excess of 6,000 lb and its fuel consumption is about 1.0 lb/hr/lb thrust—both figures under sea level static conditions. The dry weight is about 2,500 lb, nominal diameter 42in, and length about 10ft. There are six combustion chambers and a single-stage turbine.

Mr. Knowles singled out for special mention the flexible rubber thrust ring which allows some degree of angular misalignment of the centre bearing, to cater for deflections of the engine structure during aerobatics. The compressor rotor, he said, is of combined disc and drum construction.

Dart's 500-hour Test

THE 1,500-h.p. production-type Rolls-Royce Dart turboprop, as developed for the Vickers Viscount, has successfully completed a remarkable 500-hr endurance test at Derby. The schedule, which was compiled with the assistance of B.E.A., reproduced—as far as is possible on the ground—the conditions likely to be encountered by Viscounts in routine service on European routes. For instance, one portion of the test simulated requirements during the Rome-London stage of a return flight from Athens. The sequence for this part of the test was as follows: taxi-out: 6 min, 6,000 r.p.m.; take-off: 1 min, 14,500 r.p.m.; climb: 42 min, 13,300 r.p.m.; cruise, 2 hr 11 min, 13,300 r.p.m.; descent: 25 min, 10,000 r.p.m.; approach and landing, 5 min, 10,750 r.p.m.; taxi-in: 6 min, 6,000 r.p.m.

The rotational speeds used were those recommended by Rolls-Royce for commercial flying. Since the test was made at sea level, this resulted in much higher powers being developed than would be the case at altitude, so that the conditions were much more arduous than would normally be imposed.



3 INTO 1=88: Classified as "experimental" and powered by a Rolls-Royce Nene turbojet, the H.P.88 is officially stated to have been jointly designed and constructed by Handley Page, Ltd., and Blackburn and General Aircraft, Ltd. The discerning reader, however, will detect evidence of a Vickers-Supermarine finger in this most intriguing aerodynamic pie. An "experimental Handley Page wing" is stated to be embodied, and it will be judged from the photograph that this is of double-cranked plan form. The first flight was made by Mr. G. R. I. Parker, D.F.C., A.F.C., D.S.M., on June 21st.

FROM ALL QUARTERS . . .

An artificial sandstorm was raised during the taxi-out and take-off periods : sand at the rate of 0.03 grammes per cubic foot of air was injected, amounting to over 1 lb per minute at take-off r.p.m. In all, nearly 2 cwt of sand passed through the Dart. During the climb periods the oil temperature was maintained at the maximum permissible figure of 90 deg C. For thirty minutes of each "cruise" period the de-icing system was switched on, and for a portion of each "flight" water was sprayed on to the Dart to simulate a heavy rainstorm. During taxying the spray was at the rate of 50 gall/hr, and during take-off, at 150 gall/hr. On one representative flight in every 100 hr the period at take-off power was increased from 1 to 5 min, and climb and cruise were simulated at the maximum continuous power condition.

With the exception of the "flight-type" exhaust unit, which was undergoing development at the time, no parts of the Dart were replaced. The combustion equipment, including flame-tubes, burners and air casing, had previously run for 240 hr, so that these parts have now successfully completed a total of 740 hr. Maintenance and inspections were as normally scheduled and occupied a total of 46.6 man-hours, or 0.092 man-hours per engine hour.

One Dart of the same type has successfully passed three consecutive civil type-tests, namely a British type-test, a civil type-test to the schedule recently proposed by the U.S. authorities, and a repeat British type-test.

It is announced that Darts have now completed 9,500 hr on the test-bed at Derby and some 5,000 hr of flight testing have been completed without a single feathering.

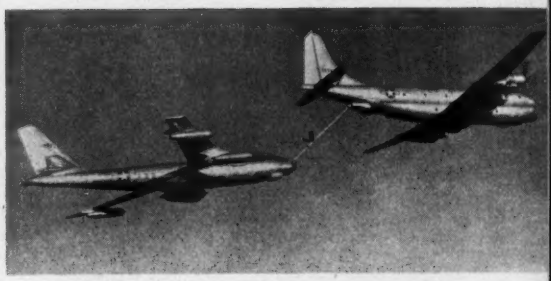
A. E. Russell Elected to Bristol Board

THE directors of The Bristol Aeroplane Company, Ltd., have elected to the board Mr. A. E. Russell, B.Sc., F.R.Ae.S., F.I.A.S., chief designer of the Company's aircraft division. Mr. Russell, who is 46 years of age, was born at Wootton-under-Edge and educated at Fairfield Secondary School, Bristol, and Bristol University. His father, a brilliant mathematician, was headmaster of East Bristol Central School and his uncle, Sir John Russell, was in 1950 elected President of the British Association.

Mr. A. E. Russell

Mr. Russell joined the Bristol stress office in 1926, became its head after two years, and remained in charge until 1932. In that year he was appointed chief technician and in 1937 deputy chief designer (aircraft). He was appointed chief designer of the aircraft division in 1943, and since then has supervised the design of all Bristol aircraft, including the Brabazon, Freighter and Type 173.

He has given two lectures in the U.S.A., addressing the joint Anglo-American Aeronautical Conference in New York in May, 1949, on *Aircraft Materials from the Designer's Point of View*, and giving the Wright Brothers Memorial Lecture in Washington in December, 1949, his subject then being *Some Factors Affecting Large Transport Aeroplanes with Turboprop Engines*. Shortly after giving this lecture, he was elected a Fellow of the Institute of Aeronautical Sciences.



A DROP OF THE RIGHT STUFF is delivered by a Boeing KC-97A Strato-freighter tanker to a B-47 jet bomber of the same make. The telescopic, swivelling "flying boom" equipment (likewise Boeing-developed) is controlled by vee-shaped "ruddevators," actuated by a gentleman (invariably known as "Clancy") in the rear of the Strato-freighter.

"Wonder Jet"

IN conjunction with Gas Turbine Week (June 18th-23rd) the film *Wonder Jet* was shown on Tuesday, June 19th, in the Telekinema at the South Bank Festival Exhibition. A Crown Film Unit production, *Wonder Jet* suffers from being too short in the sense that the endeavour to cut the film to the requisite running time has produced a somewhat patchy result.

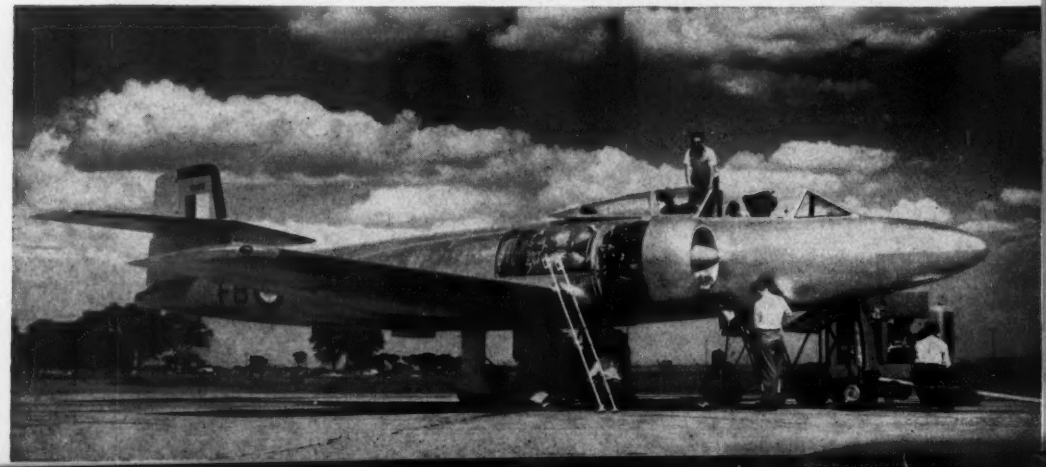
Sir Frank Whittle and Mr. W. E. P. Johnson each appear in the film in reconstructions of early events in Whittle's struggle towards success, and the film closes with some excellent shots of a diversity of modern types of jet aircraft.

English understatement has become almost a joking matter, and it was with keen appreciation that we saw John Cunningham and John Derry each studiously not looking at the camera and saying respectively that "we" (i.e., Britain's aviation industry) had achieved the world's altitude record of 59,492ft, and that "we" had also flown at above the speed of sound. Perhaps it would have been a bit too much like a trumpet voluntary for Cunningham and Derry to have used the personal pronoun in speaking of these achievements; but to have continued giving honour where it was due, the film script might, we think, have included mention of the fact that these were the actual pilots who had achieved the two records.

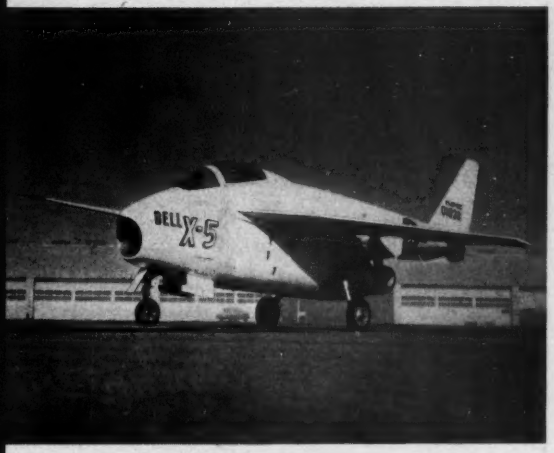
Igor Sikorsky to Lecture Here

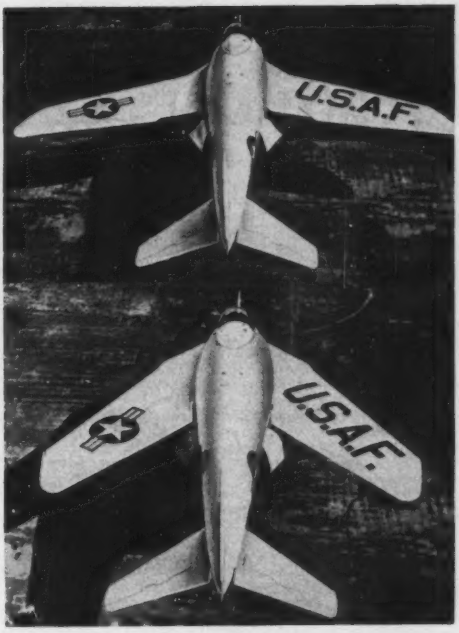
DURING his forthcoming visit to this country, Mr. Igor Sikorsky is to lecture in London at the invitation of the Helicopter Association. July 17th is the date fixed—place and time are to be announced later—and the subject is "Helicopters in Peace and War." Members of the R.Ae.S. have been invited to attend and the Association also extends an invitation "to all who are interested in the helicopter art."

The first truly "all-Canadian" aircraft is this Avro Canada CF-100 long-range day-and-night fighter with Orenda turbojets. (See news item on page 755).



CHANGE of PLAN





FIRST photographs of the Bell X-5 research aircraft, the outcome of three years' work by the U.S.A.F., the Bell Company and the N.A.C.A. As shown by the comparative views, the sweepback of the mainplanes is variable (in flight) and an unusually wide speed-range for an aircraft of this class should be attained. The power plant is an Allison J-35-A-17, and the span, with wings extended, is 32ft 9in.

Dick Peach—an Appreciation

IN the first accident involving a Canberra—it occurred at Hucknall on June 13th—a Rolls-Royce test and liaison pilot, Dick Peach, lost his life. Twenty-nine years of age, he was a well-liked member of the Hucknall test team, and a colleague has penned the following appreciation :—

"When the phoney war became a shooting war, young Dick wanted to be in on it; his ambition was to join the Navy and see action in the 'little ships'. This was not possible from a 'screened industry' (he was then a Rolls-Royce engineering apprentice), but he was allowed to join the Fleet Air Arm, which he did in November, 1941. He carried out his initial training at Sealand and Kingston, Ontario, and then, following a torpedo course at Crail, went on operations in the Indian Ocean, flying Barracudas from H.M.S. *Illustrious* in 1943-44. He will be well remembered as an instructor at Crail in 1945, where he met his wife, who was serving in the W.R.N.S. He concluded his Naval career by completing the first Maintenance Unit Test Pilots' Course at Worthy Down.

Dick Peach

"When he returned to Rolls-Royce in 1946 it was realized immediately that his Naval experience would be invaluable, and so he was made test and liaison pilot in relation to this Service.

"One of his first assignments was to introduce the use of ultra-low-r.p.m. cruising into the Seafire squadrons. He did a deck-landing refresher course and, in his visits to ships and stations, became well known and welcome, as much for his cheerful disposition as for his advice on technical flying problems.

"It was apparent that his value would be greatly enhanced by extending his experience to multi-engined bombers and transports, so the company took steps to convert him to these types and later to jets; and thus his experience came to include aircraft of all types and sizes. He followed up engine-operating problems on the Berlin Airlift, was a regular visitor to his old ship H.M.S. *Illustrious* for deck-landing trials, and took part in the Arctic trials of H.M.S. *Vengeance*. When Western Union was equipped with Meteors, he undertook to train the pilots in engine handling and flew with them in Denmark, Holland and Belgium. His most recent job had been to follow up the introduction of the Attacker into service, and to represent Naval handling problems on the Rolls-Royce Engine Handling Panel.

"His active and imaginative appreciation of the problems confronting both the operational pilot and engineer make his loss to the company the greater. His early death has cut short a career full of promise, and one which might well have been outstanding."

Queen's Cup Model Contest

OVER 15,000 aeromodellers and their friends attended the gala day of the Northern Heights Model Flying Club's annual gala meeting, held at Hawker's airfield, Langley, last Sunday, when the Queen's Cup was competed for; it was won by Mr. R. Copland. Among the guests was Air Chief Marshal Sir Hugh P. Lloyd, A.O.C.-in C. Bomber command. We shall publish an illustrated report next week.

"Daily Express" Race Entries

TO be flown on August Bank Holiday (August 6th), The *Daily Express* Race has attracted 47 entries. This year—the second time the event is being flown—the 186-mile course starts at Shoreham Airport, leads to Newhaven, thence across country to Whitstable, and back *via* the coastline, to finish at West Pier, Brighton. In addition to the challenge trophy, the winner will receive £1,000, and there are cash prizes down to 15th place (£10). Pilots and aircraft are as follows :—

H. McL. Kendall (Chilton), Capt. R. J. Crossfield (Autocrat), D. D. Dempster (Chilton), R. G. Pilkington (Auster 5), P/O. D. Norman (Moth Major), T. W. Hayhow (Aiglet), E. W. Westbrook (Messenger), P/O. M. R. T. Chandler (Hawk Trainer), F/L. P. Raymond (Hawk Trainer), G. Marler (Falcon Six), R. Matthews-Naper (Messenger), H. J. G. Turner (Hawk Trainer), Capt. J. H. Christie (Klemm), W. T. S. Buchan (Moth Minor), A. E. Coltman (Hawk Major), Miss E. L. Curtis (Wicko), W. P. I. Fillingham (Moth Minor Coupe), A. L. Cole (Comper Swift), E. Ross (Hawk Trainer), L. C. Marmol (Proctor), J. T. Basnett (Hawk Trainer), R. A. Peacock (Proctor), H.R.H. Prince Alexander of Yugoslavia (Proctor), E. Day (Hawk Trainer), J. H. Sauvage (Proctor), H. Wood (Proctor), A. S. K. Paine (Proctor), Mrs. Z. Irwin (Proctor), D. J. Bennett (Proctor), J. P. Crowther (Proctor), W/C. R. H. McIntosh (Proctor), D. J. Bennett (Proctor), W. W. Lyle (Proctor), F. C. Fisher (Miles Monarch), J. G. L. Lignel (S.F.C.A. Lignel 46), J. G. Garnier (Nord Norecrin), P. Genin (Beechcraft Bonanza), Hon M. A. R. Cayzer (Miles Aries 1), J. N. Somers (Gemini), G. Ferrari (S.A.I. Ambrosini S.7.), I. A. Forbes (Nighthawk), F. Dunkerley (Gemini), S/L. J. Rush (Falcon Six), R. R. Paine (Hawk Speed Six), H. E. Scrope (Mew Gull), Count Leonardo Bonzi (S.A.I. Ambrosini S.7.), J. K. Quill (Spitfire 22).

WESTLANDS INTRODUCE S-55

EXPERIENCED helicopter pilots (still few and far between) who flew the S-51 when it was first put into operation felt that it represented an early though practical stage in development, but that the controls left much to be desired; an experienced fixed-wing pilot requires perhaps 50 hours at the controls to fly such a helicopter with confidence. All this, however, is now changed by the use of powered controls in both the S-51 and the new S-55. For instance, with a total of only 12 hours at the controls of the S-55, Ken Reed, Westland's rotorplane pilot, demonstrated beyond doubt his confidence in this latest and largest single-rotor Westland-Sikorsky type when he put it through its paces at Chipperfield last week. The occasion was the introduction to this country of the first American-built S-55, assembled by Westlands at Yeovil. It is of the civil type with upholstered cabin—the only one to be so fitted, in fact.

The first Westland-built S-55, due for completion next spring, will be a military prototype probably fitted with a P. and W. Wasp. A production line is being set up now, even though, as was the case when Westlands licensed the S-51, the venture is a private one with no guarantee of orders. The directors—especially, we believe, Lord Aberconway, the chairman—are to be congratulated on another example of their courage and enterprise.

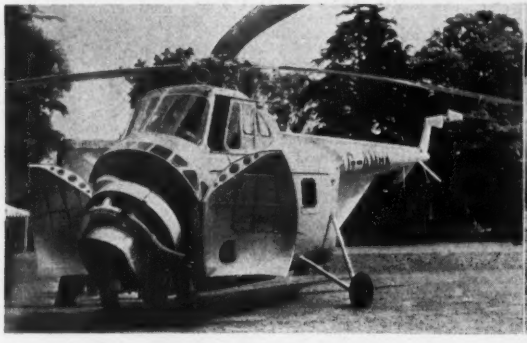
The S-55 is closely related to the earlier machine, but represents a big step forward. Briefly, it has an excellent cockpit, an easy-to-enter cabin of 3½ times the S-51's capacity, and a remarkably accessible engine. In addition, the cabin is very well positioned in relation to the aircraft c.g., and load-distribution will cause no embarrassment to operators. Controls being better than on earlier types, instrument and night flying will cause less fatigue. The S.55 will not fly hands-off, but it is neutrally stable, and there is very little lag in control response.

One military S-55 has been sent to Korea to gain experience, and it has met with remarkable success on a variety of rescue operations, which have included flying in very bad weather when fixed-wing aircraft were grounded. In a few weeks' time the Royal Navy are to take over the first machine in this country for trials—primarily in the anti-submarine role, but also for rescue, communications, radar calibration, and so on. It can accommodate ten armed troops or six stretcher cases.

On page 771 are described three advanced new Westland projects, and there are additional notes on possible developments of the S-55 which was first described in *Flight* of November 23rd, 1950.

Data on the S-55 are as follow: High speed at s.l., 110 m.p.h.; cruising speed at 70 per cent b.h.p. at 1,000 ft, 86 m.p.h.; vertical rate of climb at s.l., 350 ft/min; hovering ceiling with ground effect, 5,500 ft; service ceiling, 13,500 ft; fuel consumption (cruising), 30 gall/hr; range (with reserve), 477 miles; gross weight, 6,800 lb; useful load, 2,405 lb.; weight empty, 4,395 lb; cargo capacity, 340 cu ft; rotor diameter (blade-tip circle), 53 ft.

(Above) Having seen pilot Ken Reed bring the S.55 into the confined space of a tree-surrounded lawn, no one could doubt his confidence in the aircraft and its power-assisted controls. (Left) Aerial photographs of helicopters are rare; here the first S.55 to fly in this country is seen over the Hertfordshire countryside. (Below) The exceptional accessibility of the S-55's 600 h.p. Pratt and Whitney Wasp is shown on the left. On the right, the Westland executive group includes (l. to r.) S/L. Colvin, test pilot; Harold Penrose, chief test pilot; J. Fearn, director; K. Reed, test pilot; E. Mensforth, vice-chairman; E. C. Wheeldon, managing director; and A. Davenport, technical director. "Flight" photographs



BASIC TRAINING for the N.S. MAN

The Airwork-operated School at Booker

TO assist the regular flying training schools with the instruction of National Servicemen who have been selected for aircrew duties, several basic flying and navigation schools are being established by the R.A.F. First of the basic flying training schools is No. 1 B.F.T.S., at Booker, Buckinghamshire, operated and maintained under contract by Airwork, Ltd.

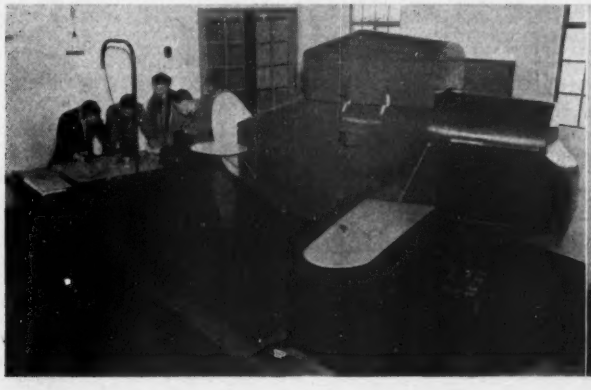
Pupils enter the school after training at the recruit centres and initial-training schools, where, after passing the aircrew selection board tests they are given the acting rank of pilot officer. Basic flying training at Booker lasts for twelve weeks. Those who successfully conclude the course pass on to a flying training school to qualify for their wings; this takes a further six months.

Forty-five pupils are at present training at Booker, of whom eleven have completed the course and will be leaving almost immediately. They are mostly between 18½ and 19 years of age, and their training is divided into three main groups: (1) ground training (flying), which consists mostly of lectures and demonstrations; (2) flying training; and (3) ground training (general service), embracing drill, games, range firing, physical training and leadership.

The school is organized in flights and echelons, and is commanded by a squadron leader R.A.F., assisted by a course-commander (flight lieutenant) and an adjutant (flying officer). The officer commanding is responsible for discipline, for instruction in Service administration and law, and for overall supervision, to ensure that the school is run on correct Service lines. All flying training, both in the air and on the ground, is the responsibility of the civilian contractor in the person of the chief instructor and manager, Mr. R. M. Hackney, a former squadron leader. Mr. Hackney has 6,000 hours' flying to his credit.

There are sixteen instructors, and the school is fortunate enough to be equipped with thirty de Havilland Chipmunks.

(Upper left) A.V-M. T. N. McEvoy, C.B., C.B.E., A.C.A.S. (Training), hears the views of A/P/O. E. L. Parrish. To his left are Mr. R. M. Hackney, chief instructor and manager at Booker, S/L. F. Rothwell, the C.O., and Mr. L. W. Howard, the C.F.I. At extreme right is G/C. I. B. Newbigging, D.F.C., of Home Command. At upper right, pupils are drilling as part of their ground training. Immediately above are some of the School's Chipmunks, and at the foot of the page are seen the Link trainer room and instruction in aerodynamics. "Flight" photographs



HERE AND THERE

ARCTIC AID: When the Canadian supply-ship "C. D. Howe" leaves Montreal in July for a three-month tour of the meteorological and fur-trading settlements along the eastern coast of Arctic Canada, she will carry two Bell helicopters. As well as acting as ship-to-shore ferries, they will pilot the vessel through pack-ice. One of them is seen flying-off from a platform on the afterdeck, during tests in the St. Lawrence River.

High Speed in France

PILOTED by Col. K. W. Rozanoff, the Nene-powered Marcel Dassault 452 Mystère covered a three-kilometre course at 1,020 km/hr (634 m.p.h.) on Thursday of last week. Subject to confirmation of the speed, this is the first time a French aircraft has exceeded 1,000 km/hr in a timed flight. The 3 km record stands at 670.98 m.p.h., to the credit of an F-86.

When Time is Money

A YORK aircraft left Stavanger, Norway, last week, carrying a replacement diesel engine for the 6,362-ton Norwegian ship *Arena*, lying at Melbourne with engine trouble. Cost of the charter is reported as £11,000—twice the price of the engine.

Rallying Round

THE Continental air-rally season gets into full swing this week-end, when the R.Ae.C. Members' Deauville Rally and the Savona, Italy, Rally are both due to take place. On the following week-end (July 7th-8th) R.Ae.C. members will fly to La Baule, and there will also be rallies at Bienne (Switzerland) and Aix-les-Bains (France).

The Russian Nene

A SPOKESMAN of the U.S.A.F. has told *Aviation Week* that the Russian Nene makes use of a "considerable number of perforation rings spaced around the combustion cans, successfully coping with one of the major heat distribution problems in that area." Another Russian design-technique being viewed with interest is a method of strengthening the stainless-steel tubular construction of the combustion chambers. The sheet is wrapped helically and welded, and U.S. experts believe this to be stronger than American and British methods. Wreckage of a Mig-15 and its engine has been flown to Tokyo.

SMALL COMPASS: The 3 oz E2A Kelvin and Hughes stand-by compass referred to on this page last week. Now standardized on R.A.F. and Naval jet aircraft, it can also be used as a main compass on sailplanes and light aircraft.

Successful Plastics Exhibition

ATTENDANCE of overseas visitors at the British Plastics Exhibition, recently held at Olympia, London, exceeded 1,500; they represented 35 countries. The organizers (Associated Iliffe Press) are discussing with the industry the question of holding the Exhibition again.

Hastings for N.Z.

SPEAKING at the recent annual general meeting of Handley Page, Ltd., Sir Frederick Handley Page said that first deliveries of the Hastings transports ordered for the R.N.Z.A.F. were expected to be made towards the end of this year; they will be C Mk 3s—basically similar to the Mk 2 but with Hercules 737 engines and certain differences in specialized equipment. Sir Frederick disclosed, also, that the M.o.S. has ordered a number of Hastings equipped as V.I.P. transports.

Goodyear "N" Takes the Air

THE newest (class N) Goodyear non-rigid airship for the U.S. Navy made a successful one-hour maiden flight on June 18th. Like other large U.S. "blimps" in current service, it is helium-filled; capacity is 875,000 cu ft, overall length 324ft, and diameter 73ft 6in. On the power of two 800 h.p. engines—understood to be Wright R-1300-2 radials—it is designed for a maximum speed of 75 kt. Useful load is nearly five tons.

Canadian Farnborough

THE growing size and vigour of Canada's aviation industry has led the Canadian Government to approve the formation of a National Aeronautical Research Committee and the creation of a National Aeronautical Establishment essentially similar in character to the R.A.E., Farnborough. The airfield at Uplands, Ottawa, has been selected for the site, and it is planned this year to provide two 200ft-wide runways, one 8,800ft long and the other 6,000ft. The first section of the Flight Research Unit is scheduled to move in during next summer.

IN BRIEF

THE integration envisaged in 1948, when the de Havilland Aircraft Co., Ltd., acquired complete control of Airspeed, Ltd., has now been fully implemented by the merging of the latter concern with the parent company.

* * *

The Ferodo service depot at Cardiff has been moved into larger premises at Ferodo House, 38/40 Charles Street. Mr. D. H. Gully remains in charge.

* * *

From Simmonds Aerocessories, Ltd., comes news that Mr. E. S. Mead (general sales manager) and Mr. C. J. Turner (works manager) have been appointed to the board.

* * *

Awco Wire Data is a new loose-leaf publication by the Aluminium Wire and Cable Co., Ltd., 37, Thurloe Street, London S.W.7. It gives designations, compositions, related British specifications and mechanical properties.

* * *

An aerial magnetometer—the airborne apparatus used, in geophysical survey, for measuring variations in the earth's magnetic field—is among the instruments made by Elliott Brothers (London) Ltd., and on view in the Dome of Discovery at the South Bank Exhibition.

* * *

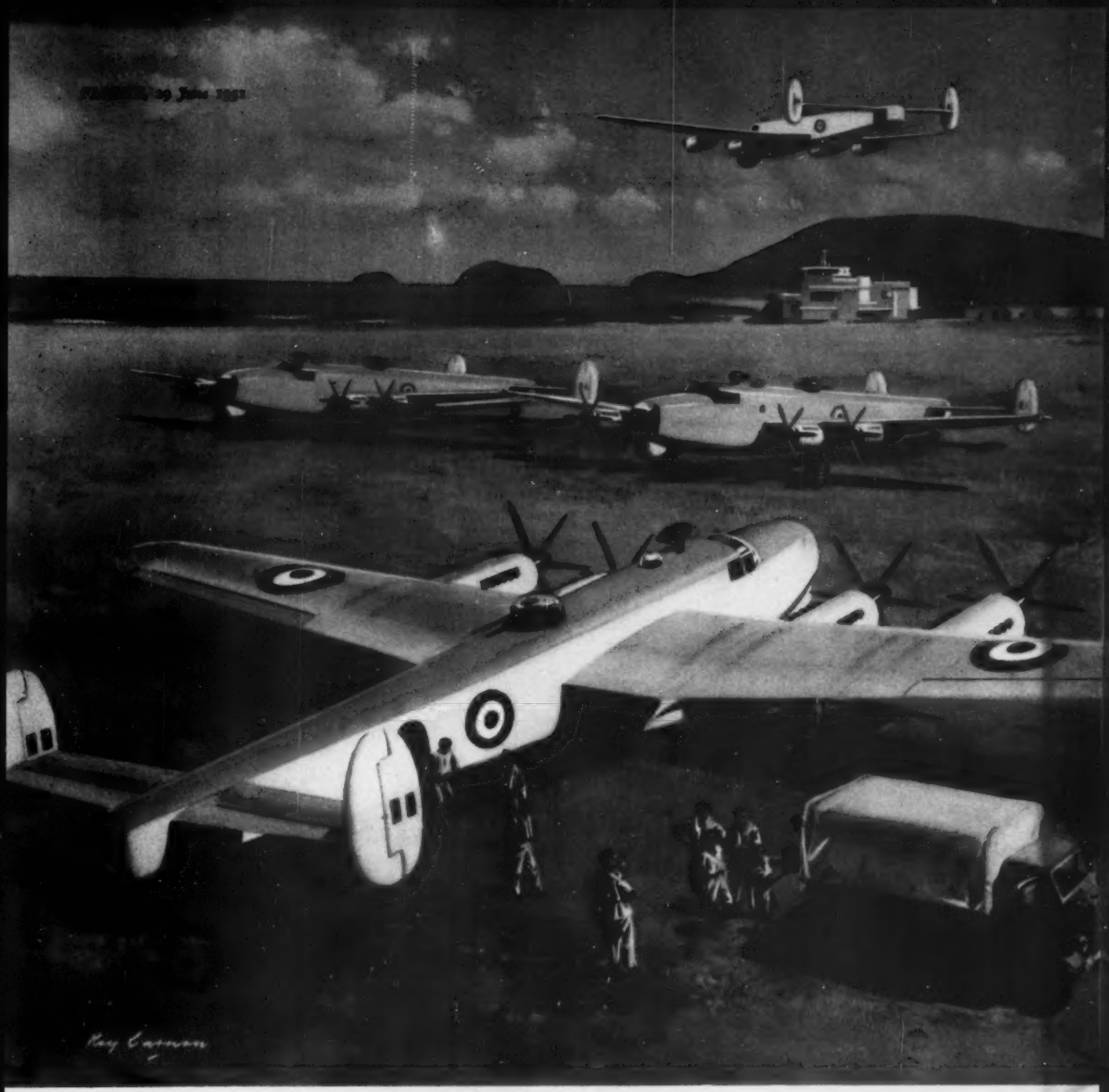
Dr. D. B. Foster, M.I.Mech.E., F.Inst.F., A.M.I.Chem.E., has joined Mullard, Ltd., as chief engineer, equipment division. He has also been appointed executive director of Mullard Equipment, Ltd.

* * *

New British aeronautical-engineering standards have recently been announced for solid and split taper pins, vulcanized rubber sheet, rubber grommets, grub screws, and testing procedures for light alloys. Details from B.S.I., 24-28, Victoria Street, London S.W.1.

* * *

Mr. G. A. Ford, test pilot of the Saunders-Roe helicopter division (formerly Cierva Autogiros) is to give up professional flying in order to live in Southern Rhodesia; he will be succeeded by Mr. J. J. M. Jeffery. Mr. Ford's friends may contact him through the Helicopter Association, 19 Park Lane, London W.1.



FRESHLY RETURNED FROM OCEAN PATROL

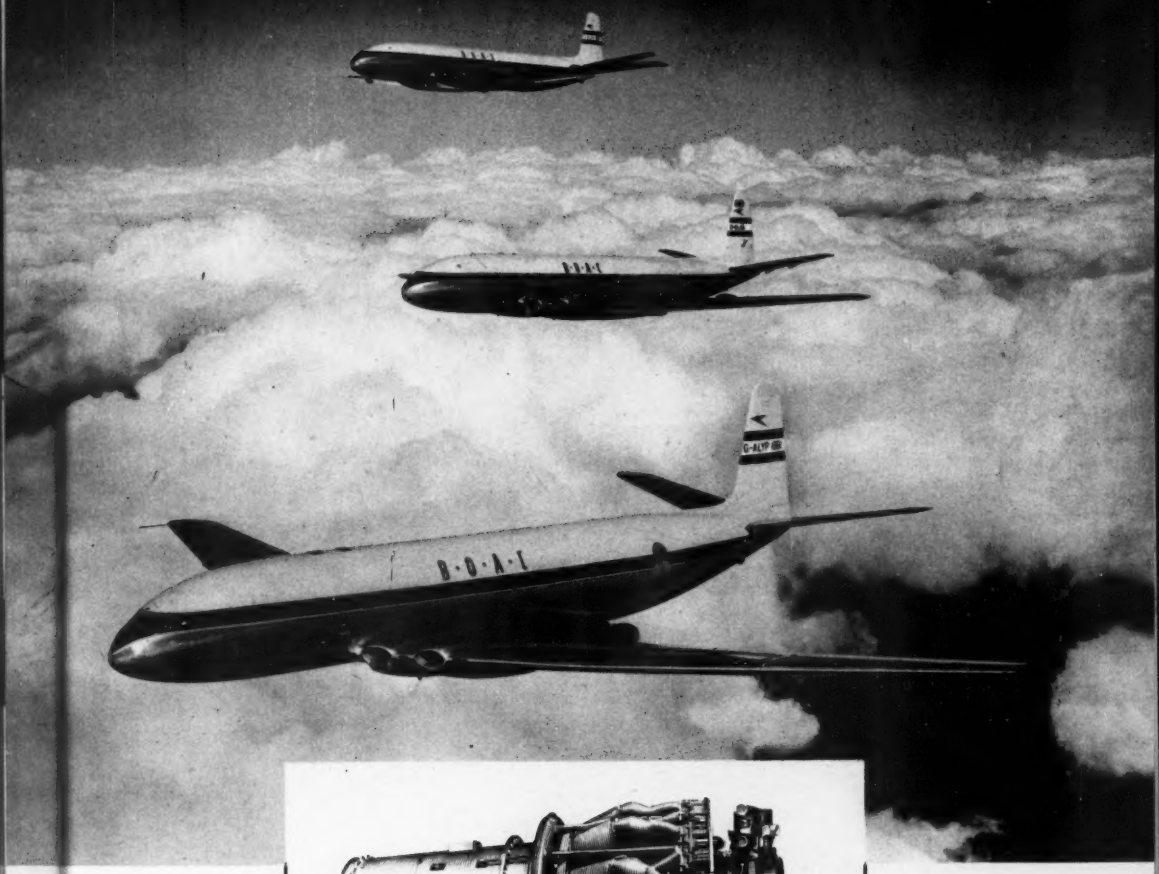
The tedium and hazard of flying over thousands of square miles of sea impose on aircrews a great mental and physical strain. But the confidence inspired by the 4 Rolls Royce Griffon engines, and the degree of crew comfort achieved by the spacious layout and galley facilities of the Avro Shackleton are such that crews of Royal Air Force Coastal Command are able to perform their arduous task more efficiently than in any other type of maritime reconnaissance aircraft.

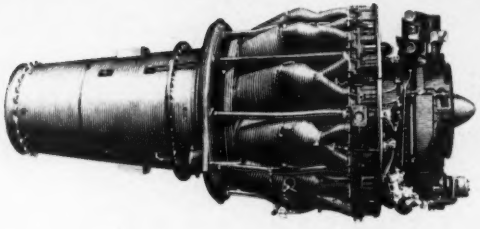
Shackleton

A V ROE & COMPANY LTD • MANCHESTER • *Member of the Hawker Siddeley Group*

GHOST

the power unit of the Comet





Inheriting a decade of development experience in centrifugal gas turbines; the Ghost is a proved engine. It is the first turbine to be type-approved by the Air Registration Board for civil use, while vastly expanding production from six entirely separate production units managed by the de Havilland Engine Company and its licencees in Western Europe sets the seal of recognition on its military excellence

DE HAVILLAND

DE HAVILLAND ENGINE CO. LTD., EDGWARE, MIDDLESEX, ENGLAND

REPORT FROM PARIS

Notes, News and Pictures from the Grand Palais

Illustrated by "Flight" Photographs

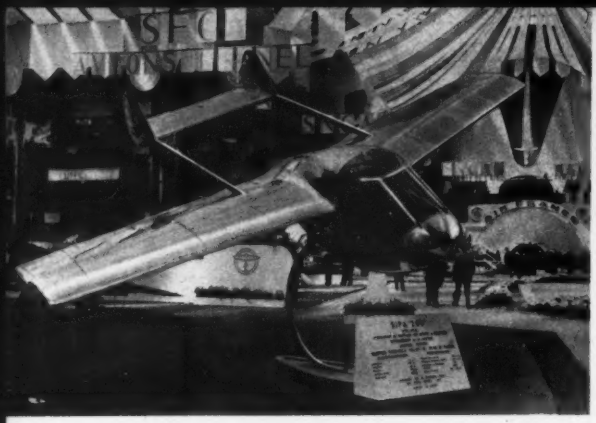
Portrayed on the left is M. Andre Granet, the organizing secretary-general of the International Aeronautical Salon, a general view of which heads the page. Below is the Aerojet Aerobee high-altitude research rocket—a striking American exhibit.

THOUGH—as will have been gathered from our preliminary report last week—there are relatively few new aircraft on display in the 19th International Aeronautical Salon, there is a good deal to be learned about developments and projects in various fields. A number of absentees from the Grand Palais will be seen at Le Bourget airfield between June 22nd and July 1st—the period of the final display.

In the Salon there is much conjecture as to the future of the French aircraft industry, and the following outline of its present status is therefore timely. The airframe and engine industry at present employs about 38,000 people and comprises three nationalized companies, one State company, and nineteen private companies. Most of these are members of a trade association equivalent to the S.B.A.C. and styled Union Syndicale des Industries Aeronautiques. One of the original four nationalized companies—the S.N.C.A.C. (Centre)—was dissolved last year.

The following types of aircraft are now in production, the quantity on order being specified, where known, in parenthesis: S.N.C.A.S.E. Armagnac transport (15); Breguet Deux Ponts four-engined freighter (15); Nord 2501 freighter (160); Dassault Ouragan jet fighter (150); S.N.C.A.S.E. Vampire and Mistral jet fighters (exact quantities not known); M.B.175 medium bomber (80 approx.); S.O.30P twin-engined medium transport (40); S.O.95 twin-engined light transport (60); Dassault 315 light military transport (300); Nord 1400 twin-engined military flying-boat (25); S.I.P.A. military trainers (184); Morane military trainers (about 500); S.C.A.N.30 twin-engined amphibian (40); S.I.P.A.901 tourer/trainer (100); N.C.853 tourer/trainer (100); S.C.A.N. 20 seaplane trainer (25).

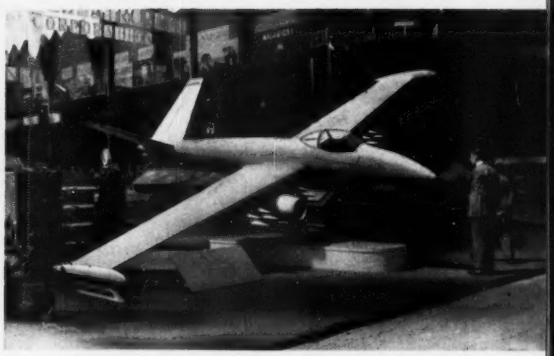
Certain new military and civil aircraft are referred to in the notes which follow.



(Left) The S.I.P.A. S.200 light communications aircraft, trainer or tourer, weighs 1,390 lb loaded, and is estimated to have a take-off run of only 200 yd. Maximum sea-level speed should be 267 m.p.h.

(Right) A particularly trim-looking trainer is the Piaggio P.1482/3-seater. The maximum speed on 190 h.p. is 147 m.p.h.; take-off run is 175 yd.

With two Turbomeca Palas turbojets, the Fouga C.M. 82R Lutin, seen below, should have an initial rate of climb of 4,300ft/min.



REPORT FROM PARIS . . .

Military Aircraft

Marcel Dassault 450 Ouragan.—The particular example of the M.D.450 Ouragan displayed bears the inscription "R No. 8," signifying that its function is reconnaissance and that it is the eighth Ouragan of the pre-production batch of fifteen. The armament is two 20 mm Hispano-Suiza guns, two having been sacrificed to permit installation of the cameras. In the bottom fuselage skin are ports for two vertical cameras, and there is a third port, for oblique photography, in the starboard side of the fuselage. Wing-tip tanks (with navigation lights) and underwing tanks are installed.

Though the first Ouragan prototype is said to have attained a speed of 613 m.p.h. at 47,000ft only two months after its first flight (made on February 28th, 1949), the placard speed of the production version is 600 m.p.h. Other data are: span, 38ft 7in; length, 34ft 9in; wing area, 269 sq ft; empty weight, 7,246 lb; gross weight, 11,684 lb; initial rate of climb, 7,800ft/min; time of climb to 39,000ft, 9 min; duration, 1 hr 10 min; take-off distance to 50ft, 985 yd; landing run from 50ft, 820 yd. The power unit is a standard Hispano-Suiza Nene of 5,000 lb thrust, and the ejector seat is a Martin-Baker.

Marcel Dassault 452 Mystère.—This Ouragan development has been flying since early this year but has been little publicized. It retains the frontal intake of the Ouragan but has swept-back wings and tail surfaces. For the present a Nene is fitted, but a Tay or Atar 1s intended. Big things are expected of the Mystère when it is demonstrated at Le Bourget on July 1st.

Marcel Dassault Aladin.—Following Sabre practice, this single-seat "all-weather" version of the Mystère has nose-mounted radar, necessitating lateral air intakes. "User requirements" have not yet been finally specified and completion of the Aladin is therefore delayed.

Marcel Dassault Harmattan.—This aircraft is a two-seater "all-weather" version of the Aladin.

S.N.C.A.S.E. Mistral.—Under de Havilland licence the S.E. factory has for some time been building the Goblin-powered Vampire, and lately, to take advantage of the Hispano-built Nene, has developed the Mistral. Innovations are the Boulton Paul-developed intakes and S.N.C.A.S.O. ejector seat. Several bag-type fuel tanks have been disposed in the wing, and there is an extra rigid tank in the nacelle. By comparison with the Vampire 5 performance has been greatly improved. The maximum sea-level speed, for example, is 578 m.p.h., and the height attained in 7 min 38 sec is 32,800ft. Corresponding figures for the Vampire 5 are 528 m.p.h. and 21,325ft. Loaded weight has increased by 405 lb to 10,000 lb and instruments and materials have been changed to conform to French standards.

S.N.C.A.S.O. Espadon 6021.—When the S.O.6020 Espadon Nene-powered fighter appeared in the previous Salon there was general criticism of the underslung air intake; so it is not surprising that this has been superseded, in the S.O.6021, by lateral flush intakes, positioned aft of the wheel wells in the fuselage sides. An S.N.C.A.S.O. ejector seat is fitted and standard armament envisaged is four 30 mm guns, though other combinations, including six 20 mm weapons, have been tested.

Manufacturer's figures are: span, 34ft 9in; length, 49ft 2in; wing area, 291 sq ft; empty weight, 10,450 lb; gross weight, 15,200 lb; max. speed at sea level, 625 m.p.h.; climb to 32,800ft, 9½ min; service ceiling, 42,650ft; duration, 1½ hr.

S.O.6025 and 6026.—These two Espadon developments resemble the 6021 but are fitted with an auxiliary rocket in a long duct beneath the fuselage. It is claimed that—increased weight notwithstanding—speed and climb performance has benefited "considerably."

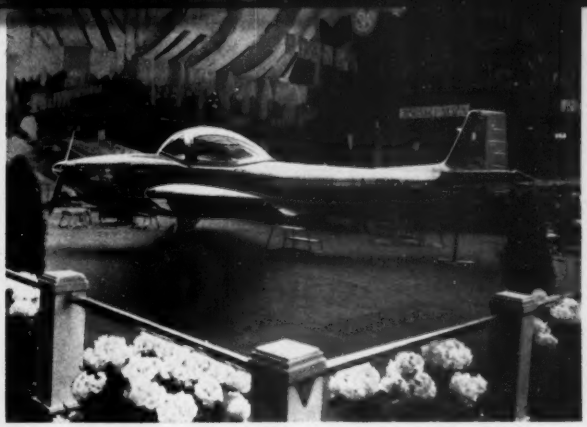
S.N.C.A.S.E. Grognards.—Two versions of this twin-jet aircraft have already been flown and a third is in prospect. The first, designated S.E.2410, made its initial flight on April 30th last year. This is a single-seater and, in common with the second variant (S.E.2415, Grognard II), has two Hispano Nene engines staggered within the deep fuselage and fed by an intake behind the cockpit. Wings and tail are sharply swept, but on the 2415 the degree of sweepback has been reduced to improve landing characteristics and manoeuvrability at altitude. The 2415 differs further from the 2410 in having a longer nose, to house radar, and a second crew member. Provision is made for a braking parachute in the tail. The Grognard II is providing experience in preparation for the third variant (S.E.2420, Grognard III), intended primarily for ground attack.

Data for the Grognard II are: span, 50ft 7in; length, 54ft 9in; height, 19ft; wing area, 469 sq ft; gross weight, 36,100 lb; max. speed, 595 m.p.h.

Arsenal VG-90.—The team of Vernisse and Galtier, active at the Arsenal de l'Aéronautique, is known for originality of design, and the the VG-90 naval strike-fighter, built in the light of experience with the VG-70 Jumo-powered research aircraft displayed in the 1946 Salon, is a striking-looking machine, of shoulder-wing layout. The first prototype was destroyed in May of last year, but results were described as very promising and work went ahead on a second specimen, now ready to fly. Unlike its precursor, this is of all-metal construction, and the ailerons have a Fairey Hydro-Booster power-control system. Certain details of the undercarriage have been changed; the rudder is in two sections; and Normalair equipment is installed. The armament is three 30 mm guns, and provision is made for bombs or R.P.s beneath the wings. In the third example the rear fuselage is being adapted to house a Hispano Tay, a Nene with afterburner or a S.N.E.C.M.A. Atar. There is also talk of Arsenal ramjets being mounted experimentally at the wing-tips. The all-up weight is about 18,000 lb.

Arsenal Intercepter.—Work is in hand on an Arsenal intercepter fighter, the final configuration of which is dependent upon the results of trials with two prototypes of the VG-90 naval fighter (Nene) and of a scale-model glider now on test. This glider, of wooden construction, has heavily swept wing and tail surfaces, and is towed behind a Siebel 204 at speeds up to 220 m.p.h.

Bréguet 960 Vultur.—A model displays the striking lines of this carrier-borne reconnaissance and strike aircraft, powered with an Armstrong Siddeley Mamba turboprop and Hispano Nene turbojet. Details of military equipment are withheld, but a model displayed in the Salon two years ago indicated provision for



The Fiat trainers above are the Merlin-powered G.59-4B and the lighter G.46. In the foreground is the beautifully made wing of the new Fiat G.80 jet trainer, to be powered by a D.H. Goblin or a Rolls-Royce Nene.

internally stowed rocket projectiles, launched from a special retractable framework. The cockpit is far forward in the nose and accommodates a crew of two, side by side, on ejector seats. The Nene is fed from wing-root intakes. At the wing-tips, provision is made for extra tanks or, on one side, a radar housing and on the other a similarly shaped fairing to preserve aerodynamic equilibrium. Dive brakes of large area are built into the sides of the rear fuselage. Two prototypes, the first of which should fly shortly, are under construction.

Manufacturer's data follow: span, 54ft 3in; span (folded) 24ft 2in; length, 43ft 4 in; height, 16ft 8in; empty weight, 15,500 lb approx.; gross weight, 22,000 lb approx; cruising speed (Mamba power only), 248 m.p.h.; max. speed (Mamba and Nene), 560 m.p.h.; landing speed, 93 m.p.h.; absolute ceiling, 42,600ft; cruising duration (Mamba only), 4.3 hr.

Bréguet 961.—A painting of this land-based ground-attack version of the Vultur shows that, unlike the naval variant, it is a single-seater. Provision will be made for various power units and a version with swept-back wings is under consideration. Mention has been made of an all-weather fighter development, and it is evident that a machine of this type is well suited for night intruder operations.

Fokker S.14.—There is much to commend in Fokker's S.14 single-jet trainer, laid out for tactical training in addition to its primary duties of transition, instrument-flying and navigational instruction. Especially well received is the side-by-side disposition of the two Martin-Baker ejector seats; these are enclosed by an aerodynamically smooth jettisonable hood, electrically opened and closed along a central rail. Within the cockpit section, additional to dual flying controls, are the radio, oxygen and accumulator; to the rear is the engine compartment, housing the Rolls-Royce Derwent 9 turbojet, of 3,600 lb thrust, with its dual-drive unit for generator compressor and vacuum pump. The circular nose air-intake is bifurcated to feed the plenum chamber. Fuel tanks, of 400 gall capacity, are located in the inner and outer sections of the low wing. Removable panels allow the tanks to be changed quickly.

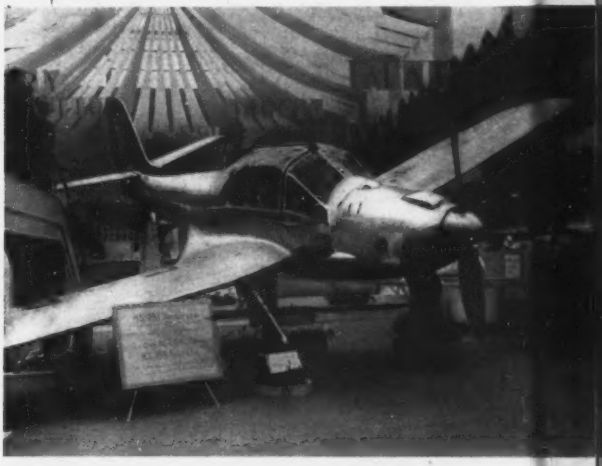
The nosewheel undercarriage is pneumatically operated and all three units are of Dowty levered-suspension type, with liquid-spring shock-absorption. The nosewheel tyre is of the twin-contact variety.

S.I.P.A. S.200.—Though interesting as a potential private-owner type, this little jet-propelled side-by-side two-seater is primarily a high-speed, short-range, communications aircraft or trainer. Two prototypes are being built. As becomes a modern jet aircraft the S.200 has laminar-flow wings, high-lift flaps and a retractable nosewheel undercarriage.

Dimensions, weights and estimated performance figures follow: span, 23.6ft; length, 16.8ft; height, 5.8ft; wing area, 91.5 sq ft; equipped weight, 640 lb; fuel and oil, 352 lb; luggage and movable equipment, 33 lb; pilot and passenger/pupil, 366 lb; all-up weight, 1,390 lb; max. speed at sea level, 267 m.p.h.; max. cruising speed at 3,300 ft, 236 m.p.h.; unstick run, 200 yd; ceiling, 26,250ft; range, 300-370 miles.

Fouga C.M.821R.—The Fouga Lutin (C.M.82R) displayed is a ¼-scale model for the C.M.821R trainer or light ground-attack aircraft, to be powered with two Turbomeca Marbore engines. Provision will be made in this type for twelve rocket projectiles and one Hispano-Suiza 404 M.49 cannon, with 200 rounds of ammunition.

Below is the Morane 731 prototype, from which the 732 and 733, with retractable undercarriage, are being developed. Spot-welding is extensively employed and initial cost should be relatively low.



A military trainer (single or two-seat) having a strong appeal for the sporting pilot is the Ambrosini (S.A.I.) S.7, available with Gipsy Queen or Alfa engine. Provision is made for a 7·7 mm machine gun.

Helicopters

THAT the French have, in their S.O.1120 (Ariel III), evolved a helicopter design of exceptional merit is an indisputable fact. The scheme of driving rotors by tip-jets fed from a turbine-driven compressor and obtaining directional control by diverting the exhaust flux carries with it an attractive freedom from the necessity for complex and costly transmission systems and tail rotors. The

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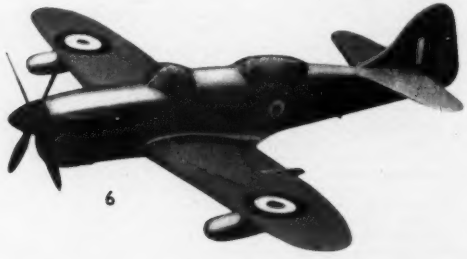
MODELS OF—

1. S.E.4030 amphibian, with Armstrong Siddeley Cheetah or Pratt and Whitney engines.
2. Breguet 96 two-seater carrier-borne strike or reconnaissance aircraft (Armstrong Siddeley Mamba and Hispano-Suiza Nene).
3. S.E.2420 Grognard III attack-bomber, with eight guns.
4. Fouga C.M.170R—a projected twin-jet, tandem-seat, trainer.
5. Fiat G.80 jet trainer, designed to take either a Goblin or a Nene.
6. Fairey Firefly 7 anti-submarine aircraft, on order for the Royal Navy.



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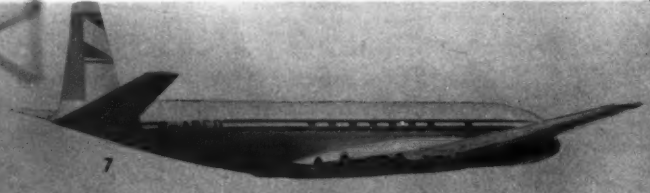

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7. The de Havilland Comet—a very highly finished representation of an unrivalled airliner.
8. Harel-Dubois H.D.31 freighter, with an aspect ratio of 20.2 : 1. Engines: 2 Wright C7BA1.
9. S.N.C.A.S.E. Superarmagnac, intended to have Bristol Proteus or Allison turboprops.

8

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Bristol 175, with four beautifully cowled Proteus.

REPORT FROM PARIS . . .

Ariel III's Turbomeca Artouste, supplied from a 400-litre kerosene tank, gives the machine a range of about 155 miles, with a maximum duration of 2¼ hr. The turbine does not require an air intake in the accepted sense of the word, a grille in the side cowlings merely being used to maintain a slightly higher air pressure inside the chamber housing the turbine. The Ariel III's maximum speed is 103 m.p.h. and its disposable load is 1,257 lb.

S.N.C.A.S.O., incidentally, is now studying a combined "aircraft-helicopter," powered by multiple turbines feeding a tip-jet driven rotor (for helicopter flight) and ordinary aircrews for normal flight. In the latter case lift will be obtained primarily from fixed aerofoils and secondly by the rotor in auto-rotation.

Current helicopter construction in France could certainly not be dismissed, however, without a word on the simple yet well-designed S.E. 3120, a general-utility three-seater, which is actually an improved version of the experimental 3010 and 3110 prototypes; it was scheduled to make its first flight last week. Its gross weight is 1,150 kg and it is powered by a Salmson 9NH piston engine of 200 h.p. Of conventional configuration, it is characterized principally by its large cabin, in which the seats on either side of the pilot may be easily removed if stretchers are to be installed. An agricultural version will have two hoppers and tanks, with spray nozzles fitted to the landing gear chassis.

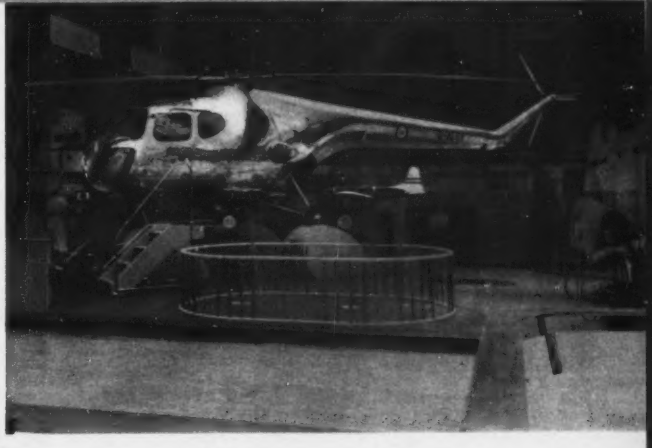
Transport Aircraft

Hurel-Dubois H.D.31.—Designed in the light of experience with the H.D.10 ultra-high-aspect-ratio research aircraft (actually displayed in the Salon), the H.D.31 is a freighter, intended for two Wright C.7 engines of 800 h.p. each and having a span of 147ft 7in, the aspect ratio being 20.2 : 1. Empty and gross weights are, respectively, 18,900 lb and 29,900 lb, and the cruising speed should be about 149 m.p.h. Initial rate of climb is quoted at 787ft/min, and the take-off run to clear 50ft should be about 600 yd. The range is short, being little more than 300 miles. The cockpit is designed for a crew of three, and 40 seats are optional fittings in the cabin.

S.O.5100 Champagne.—The Bureaux d'Etudes of S.N.C.A.S.O. are working on a Comet-like transport designated as above and intended to have four Nenes, Tays or Atars. The cabin will be pressurized to 8,200 ft equivalent for operation at 39,500 ft., and the gross weight should approach 110,000 lb. Cruising speeds of the order of 470–510 m.p.h. are foreseen.

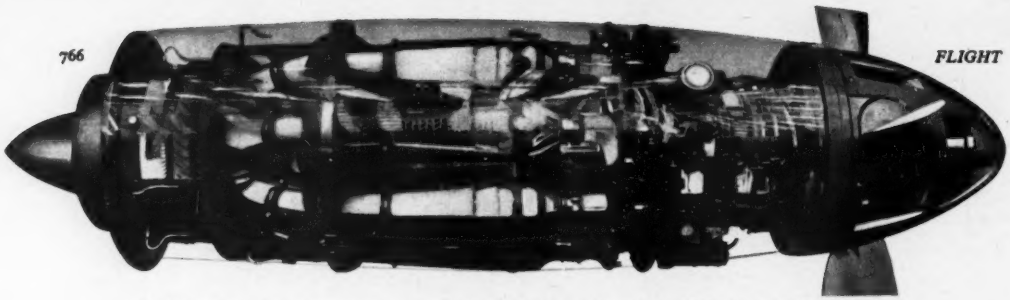
S.E. Superarmagnac.—The fifteenth Armagnac transport will be powered with four Bristol Proteus or Allison T-40 turboprops, necessitating relatively minor alterations to the wing, but allowing an increase in all-up weight to 88 tons and giving a cruising speed of 350 m.p.h. The range should be over 4,000 miles.

Breguet 970 Fulgur.—Two versions of this 45-ton transport

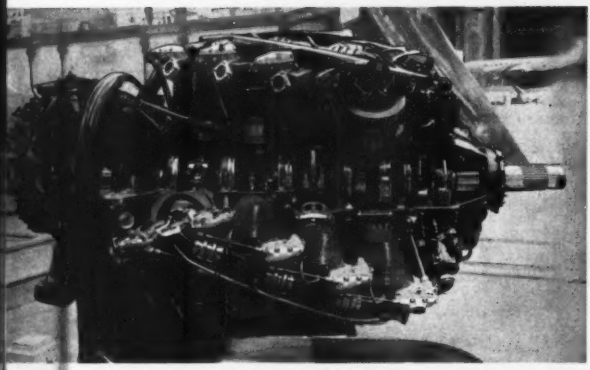


(Right) Bristol 171 Mk 3 Alvis Leonides-powered helicopter.

(Below) Having the appearance of a German V.1 flying bomb, the Arsenal S.501 is actually a radio-controlled target. It is launched from a 39ft catapult, which gives it an initial speed of 240 m.p.h. The aircraft descends by parachute. A few yards from the ground a proximity fuse fires two braking rockets to absorb landing shock.



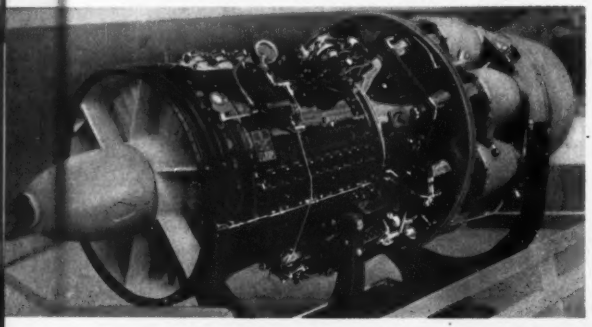
French designers of large transport were among the many who showed interest in the 3,250 s.h.p. Bristol Proteus turboprop. The shapely nacelle form of this revealing large cut-away exhibit was preserved by a Perspex covering. The modified nacelle for the Proteus in the Bristol 175 could be examined in model form on the company's aircraft stand.



A fine cut-away exhibit—and a remarkable feat of engineering: the Pratt and Whitney 28-cylinder Wasp Major. In the 3,500 h.p. class, it powers several important U.S. civil and military aircraft.

FRENCH PISTON-ENGINES AT THE SALON

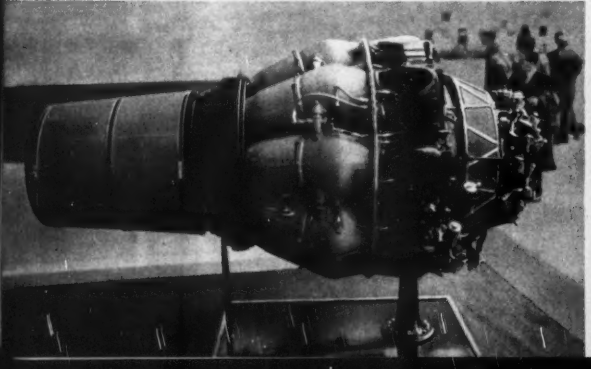
Name	Cylinder arrangement	Capacity (litres)	Take-off (h.p.)	Take-off (r.p.m.)	Cruising Power (h.p.)	Cruising Power (r.p.m.)	Weight (lb)
Hispano-Suiza:							
H.S. 12Z ...	12V	36	1,300	2,650	820	1,950	1,365
Minié:—							
4 DF14 ...	4 H.O.	1.37	—	—	35	2,600	101
4 DF28 ...	4 H.O.	2.80	—	—	65	2,420	185
4 DC32A and C	4 H.O.	3	80	2,610	75	2,575	190
Potez:—							
4 D-01 ...	4IL	5.85	160	2,520	94	2,120	315
4 D-31 ...	4IL	5.85	220	2,600	130	2,200	366
6 D-00 ...	6IL	8.77	240	2,530	140	2,120	485
8 D-30 ...	8IV	11.7	450	2,800	270	2,350	738
12 D-30 ...	12HO	17.6	650	2,800	405	2,350	970
S.N.E.C.M.A.:—							
14 X.02 and 04	14 2R	19	820	3,100	410	2,350	1,311
Salmson:—							
9 AD8 ...	9R	2.98	59	2,350	45	2,220	174
5 AQ.01 ...	5R	3.92	90	2,550	79	2,440	213
7 AQ.03 ...	7R	5.49	150	3,100	135	3,000	330
9 NH ...	9R	9.90	203	2,150	175	2,050	359
8 AS.02 ...	8IV	12.66	250	2,000	230	1,940	535
Arsenal:—							
12H	12IV	70	2,250	3,250	1,100	2,400	2,100
Renault:—							
125	12IV	12	574	3,300	296	2,800	1,159

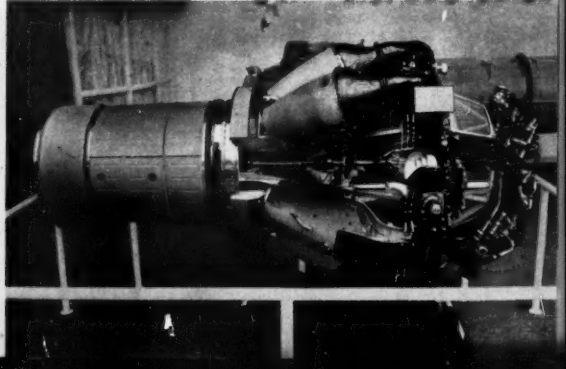


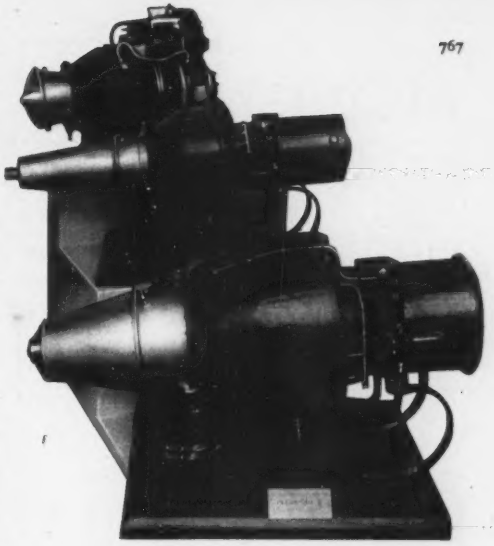
FRENCH GAS TURBINES ON SHOW

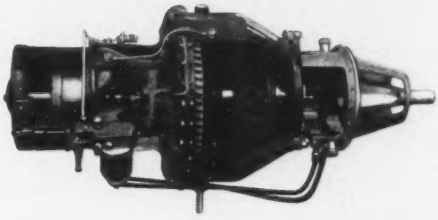
Name	Take-off Power (lb or s.h.p.*)	Cont. Power (lb or s.h.p.*.)	Specific Consumpt. (kg/hr/kg)	Bare Weight (lb)
Hispano-Suiza:—				
Nene	5,070	3,450	1.05	1,608
Nene (reheat) ...	6,500	—	1.95	2,200
Tay	6,280	—	1.06	1,970
S.N.E.C.M.A.:—				
Atar 101 ...	6,170	5,071	1.0	1,970
Atar 101E ...	7,275	—	—	—
Atar 101F ...	8,815	—	—	—
T.B. 1000 ...	1,450*	1,050*	0.75	1,060
T.B. 1000A ...	2,000*	—	—	990
Escopette ...	22	—	1.4	10.5
Turbomeca:—				
Piméné	220	176	1.08	92
Palas	330	304	1.12	132
Marbore I ...	661	518	1.00	—
Marbore II ...	838	705	1.08	—
Aspin I	485	353	0.58	—
Oredon	160*	130*	—	—
Artouste ...	280*	160/180*	0.89	185

Immediately above is the magnificent Rolls-Royce Avon, making its first show appearance. Visible are the tangentially disposed struts in the intake, the variable-pitch vanes (referred to last week) and the pneumatic jack which operates them. Maximum thrust quoted for this mark is 6,500 lb. (Below) Unmistakably bearing the Rolls-Royce stamp: the Tay, as built by Hispano-Suiza. Note the large-diameter turbine casing and the combustion-chamber construction. A thrust of 6,280 lb is quoted in France. (Below, right) This cut-away Hispano Nene, identical with the British product except for accessories, and with French materials to the same specification, forms an interesting comparison with the Tay. The thrust figure is 5,050 lb.









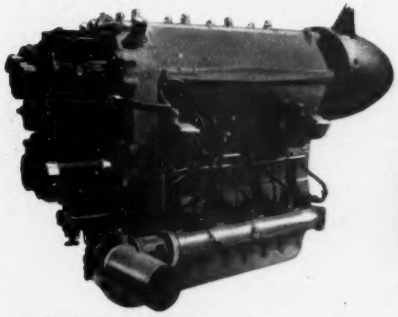
(Right) Nearest of the three Turbomeca units—some of a large range which bear close family likeness—is the Marbore I turbojet of 660 lb thrust. Behind it is the smaller Palas (330 lb thrust), examples of which may soon be seen in this country. Beyond, again, is the Oredon which produces 160 h.p. at the shaft. Below the Marbore is the forerunner of a line of Turbomeca units, the T.R.01 or Piméné (220 lb thrust) has proved to be exceptionally reliable during bench tests and flying experience. The simplicity of its construction was revealed by a cutaway exhibit. Next, reading downwards, is illustrated a civil mark of Ghost cut away to reveal both its simplicity and rugged construction. Maximum thrust of the Ghost is 5,000 lb. This exhibit by the D.H. Engine Company was appropriate in view of the French order for Comets. (Below) Several important applications are now foreseen for Blackburn's latest 185 h.p. Bombardier. Note the neatly grouped accessories on the rear drive casing and the simplicity of the S.U. petrol injection system. The Bombardier is approved for use with constant-speed airscrew.

REPORT FROM PARIS . . .

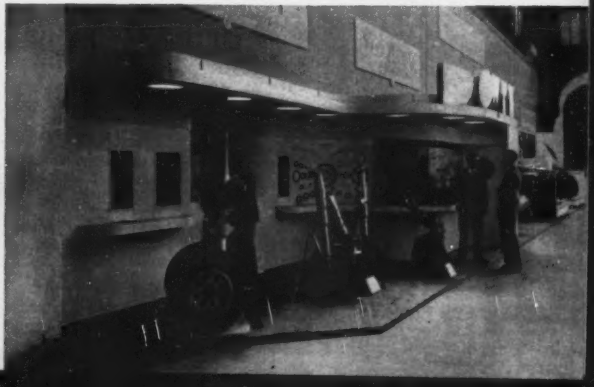
are planned—one with four Armstrong Siddeley Double Mambas cruising at 370 m.p.h. at 23,000ft, and a second, with Tays or Atars, cruising at about 430 m.p.h. at 26,000ft. Accommodation for 96 passengers and about five tons of freight is intended.

Fouga C.M.101R.—There is marked interest in France in the application of auxiliary turbojets to transport aircraft, and this development of the C.M.100 has two Turbomeca Piménés behind the 500 h.p. S.N.E.C.M.A. piston engines. The Piménés are intended to provide a higher degree of safety and afford better "exploitation." The take-off run with the assistance of the jets is about 500 yd. Other data relative to this interesting little transport are: span, 86ft 9in; wing area, 774 sq ft; cabin capacity, 1,130 cu ft; gross weight, 18,200 lb; cruising speed, 152 m.p.h.

S.N.C.A.N. Nord 2501.—Though the scale model of this aircraft displayed in the Salon shows it equipped for civil passenger transport, the 160 examples now in production are for military use. Two Bristol Hercules 739 engines now installed give a cruising speed of 208 m.p.h. and a maximum speed of 274 m.p.h. The disposable load is about 6 tons and the maximum permissible weight about 20 tons. Cabin capacity is 1,805 cu ft and the range, with a payload of 11,700 lb, is 930 miles. As on the Fairchild Packet, which the Nord 2501 closely resembles, the rear section of the fuselage can be removed to permit the parachuting of vehicles and heavy stores. Special freight-handling tackle is fitted in the fuselage. The normal crew is four.



The products of several British manufacturers were to be found on the stands of their Continental agents. Below, for example, can be seen exhibits of instrument-testing equipment from Bryans Aeroquipment, Ltd., and instruments and components by George Kent, Ltd., and Avimo, Ltd. On the stand of Worldmarket et Cie, visible to the left, were examples of Plessey cartridge starters. In the right-hand picture are full-scale Dowty components for British military aircraft now in production; these formed the company's main exhibit. Left to right are seen the nosewheel for the Avro Ashton, landing-wheels for the Gloster Meteor N.F.11, and a nosewheel for the Hawker Sea Hawk.



EVOLUTION OF THE GUIDED MISSILE

By KENNETH W. GATLAND

Part III: Problems of the Heavyweight Supersonic Rocket: The German A-9/A-10 Projects

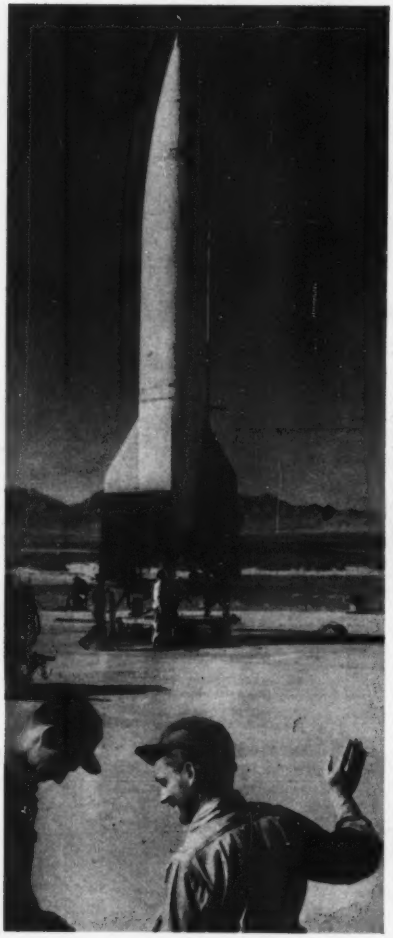


Fig. 15. A captured German A-4 (V.2) rocket about to be fired. It is probable that such rockets have now been developed to carry atomic warheads.

In the first part of this article, in our issue of May 4th, the author discussed general aspects of his subject and reviewed certain rocket-propelled ground-to-air missiles; Part II (May 18th) went on to discuss air-to-air missiles and rocket-driven interceptors. The present instalment reviews the development programme carried out by the Germans with the A-4 ("V.2") rocket and its projected derivatives. In Part IV Mr. Gatland will deal with the use of rockets as instrument-carriers for high-altitude research.

IN formulating our defence plan, we must bear in mind means of attack other than by the jet-bomber—in particular, by the supersonic rocket. Would the offensive use of guided missiles against this country represent a serious hazard? We are told that the day of "press-button" aerial warfare is still far off, that manpower and conventional methods of attack and defence must remain the essential backbone of the fighting services. That, of course, is true. The guided missile is still an undeveloped weapon and several years of fundamental research will be required before it can challenge the bomber as a means of delivering explosive over long range. Nevertheless, it cannot be dismissed so lightly where the range is comparatively short. Whereas for some years the United States is reasonably secure from attack by land-based rockets, an aggressor has only to occupy the Low Countries to be able once again to strike at London and South-East England.

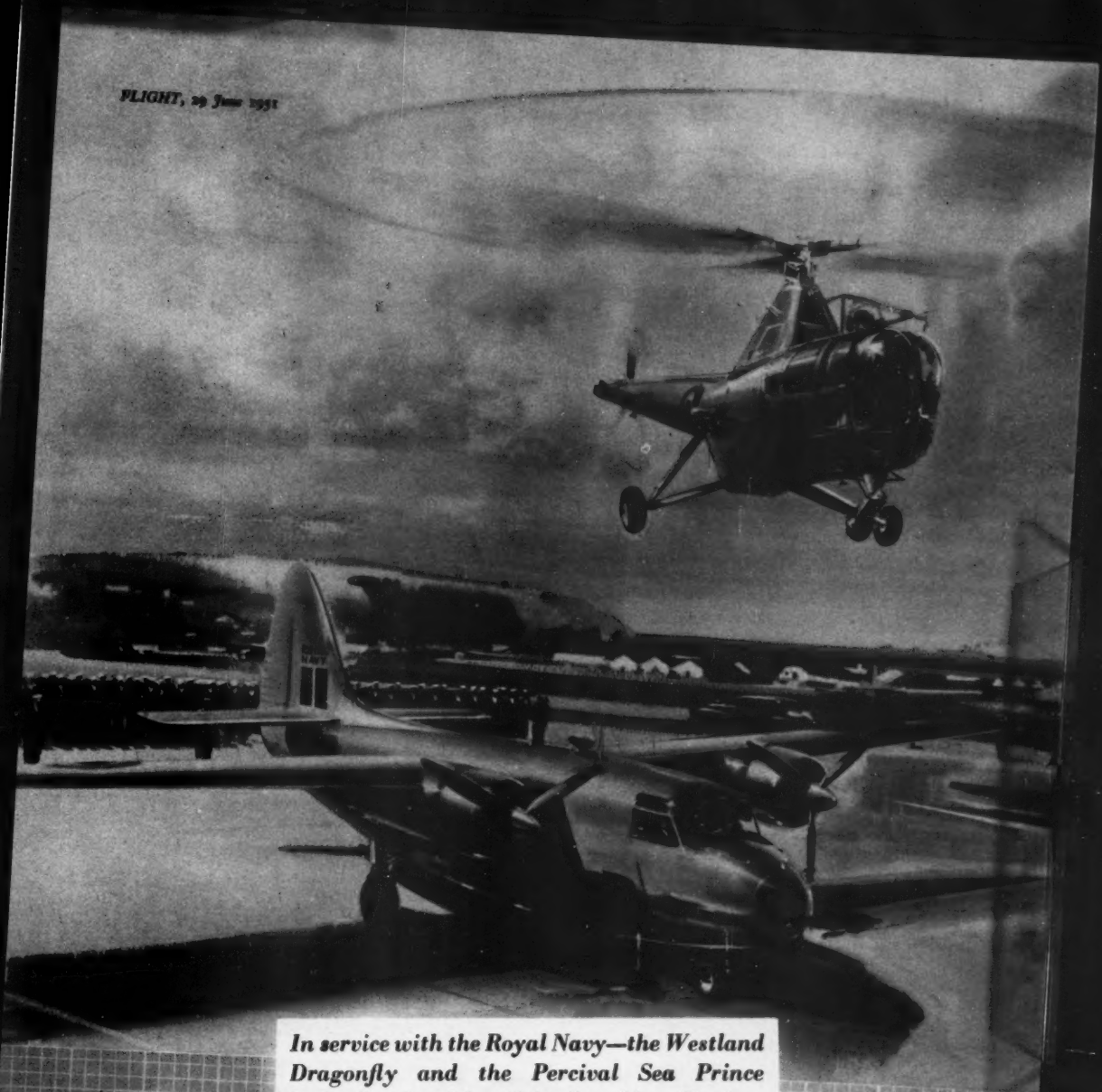
In the war, our sole means of defence was to seek out and destroy the rockets before they could be launched. This was difficult because component manufacture was dispersed, the parts were assembled in protected factories (in some cases underground), the missiles were fired from plain surfaces without a launching device (see Fig. 15), and transport and servicing were highly mobile operations. Once the rocket was in flight at the correct elevation, nothing could prevent its arrival.

Today, it would be surprising if rockets have not been developed to carry atomic explosive. The seriousness of the position is conveyed by the fact that even the German A-4 rocket—more familiarly known in England as the V.2—could probably be made to deliver atomic explosive over distances up to 200 miles. It has been suggested that to achieve an "air burst" effect, the warhead would be separated from the main body of the rocket during a final stage of the descent. It is significant here to note that explosive separation of the A-4 warhead, with successful recovery of the one-ton compartment by automatic parachute, has already been achieved during experiments by the U.S. Army. In all probability, however, even this technique would be unnecessary, as it appears that the desired "air burst" could be obtained by means of a device triggered by a radio-altimeter whilst the missile is actually dropping at supersonic speed.

A small, highly industrialized country such as Britain is the ideal target for rockets, and those of our military advisers who have neglected the problem "because the rocket is inaccurate and consequently is of slight tactical importance," may have cause to think again. Is pin-point accuracy really so essential with the atomic bomb? In any case, the development of snort-type submarines for guiding rockets is not a particularly difficult task, and this would make it possible to direct missiles with a fair degree of precision. Indeed, the submarine may become an important factor both in the control of missiles launched from land bases and as a launching platform itself. Tests recently carried out in the Pacific by the U.S. Navy have shown that guided missiles can be effectively operated from submarines. In Fig. 16, an American-built "flying bomb" is seen rising from the U.S.S. *Carbonero* under rocket assistance before being guided down a line of ships as a gunnery target. Submarines capable of operating "flying bombs" and short-range rockets could seriously menace cities on the United States seaboard.

Whilst the same could also apply to Britain, the close proximity of key military and industrial centres to potential launching sites on the Continent suggests that our greatest problem lies with the large V.2 type of rocket.

Let us admit directly that a practical means of defence against the supersonic missile does not exist. On paper, the answer is plain enough. The specification for an *anti-missile* rocket can easily be drawn up—but only after many years of intensive research could such a vehicle be constructed.



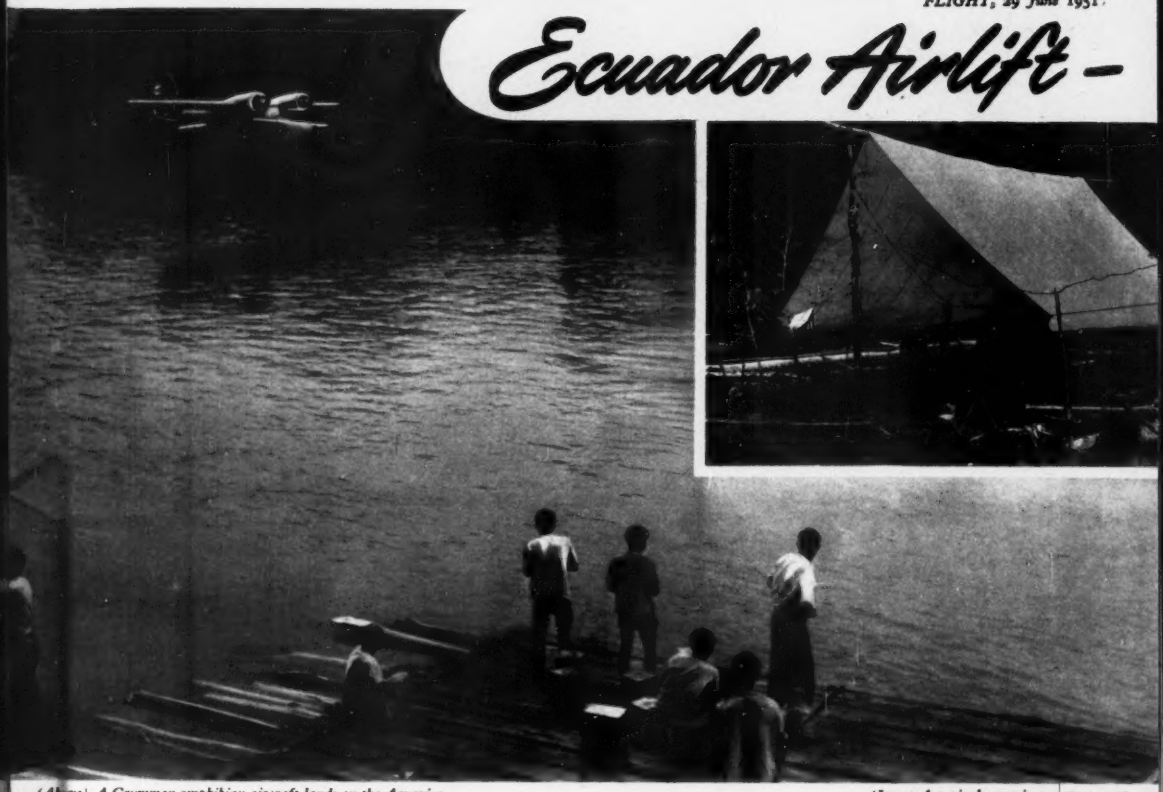
In service with the Royal Navy—the Westland Dragonfly and the Percival Sea Prince both fitted with Alvis Leonides Engines

ALVIS

LEONIDES

ALVIS LIMITED, COVENTRY, ENGLAND

Ecuador Airlift –



(Above) A Grumman amphibian aircraft lands on the Aguarico river near a survey camp in the Oriente region of Ecuador.

(Inset) A typical scene in a survey camp in the Oriente region of Ecuador.

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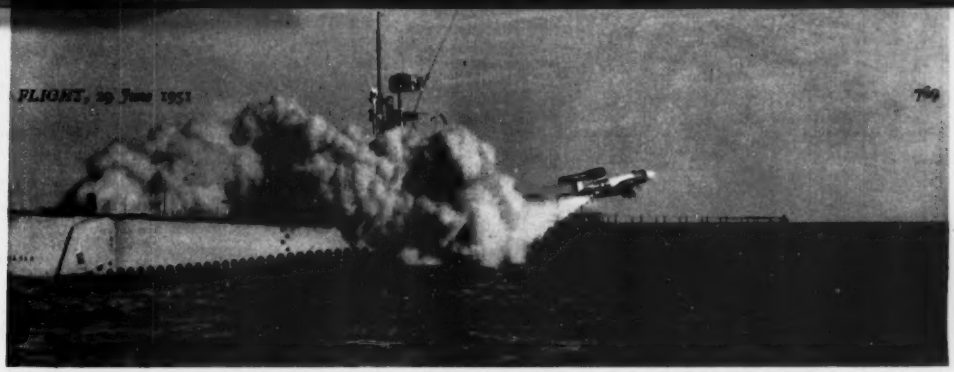

Fig. 16. The U.S. submarine "Carbonero" launching a guided missile. Such vessels operating "flying bombs" and short-range rockets could seriously menace the United States. They would also be effective "command posts" for controlling missiles over long range.

The air defence rockets we are developing today are simple devices compared with the type of missiles envisaged. A rocket capable of catching and destroying another rocket will be larger, faster and longer ranging, its control system more sensitive and rapid in response. A radar system will be required to detect the oncoming enemy missile before it reaches the peak of its trajectory and to trigger off the intercepting rocket. In the same way that a command system will represent the course of bomber and missile and guide the latter to its objective, so will tracking radar follow the course of each rocket and, in conjunction with a computer, aim the defending missile. When it is close enough to the invader, it will be detonated by a radio-fuse.

In case it carries an atomic warhead, the incoming missile must be halted as far from its objective as possible. When it is considered that the A-4 rocket was in flight for only five minutes during the whole time from launch to impact, the magnitude of the problem can be appreciated. And, of course, several missiles will probably have to be dealt with simultaneously.

Rocket missiles capable of high accelerations, and a guidance system to produce the necessary split-second response, are foremost requirements. Indeed, all the most difficult problems met in the development of rockets capable of intercepting bombers are magnified many times—exactly how many we can only properly judge when we come to tackle them. In the opinion of the writer, the Americans have made a valuable start by conducting high-altitude research and thereby gaining experience with large rockets.

How they began in 1946 with adapted German A-4 rockets and built up their high-altitude programme is well known, and it is in many ways unfortunate that British research was not allowed to follow similar lines. Considerable stores of A-4 equipment fell into our hands after the surrender, and much useful work was undertaken by the Army at Cuxhaven, using German personnel, to rebuild damaged rockets and to provide complete servicing and launching facilities. In fact, what might have been the basis of a firm research foundation was built up within the space of a few months, but apart from a critical report on the accuracy of long-range rockets (which in the tests had been aimed at targets in the sea) and a 40-minute film,* there appear to have been few material results.

So much has already been written about the A-4 rocket, particularly by the late W. G. A. Perring in his paper, *A Critical Review of German Long-range Rocket Development* (*Journal* of the Royal Aeronautical Society, July, 1946), that nothing need be added here. Not so widely known are the methods proposed for extending the range of the A-4, first by the simple addition of wings (the A-9) and secondly by means of wings and a powerful rocket booster (the A-9/A-10).

Although it was later intended to employ a heavier fuel load, lighter construction and an improved propulsion unit, the prototype A-9 (Fig. 17) was essentially an A-4 with swept-back wings and enlarged aerodynamic control surfaces. Preliminary work on the application of wings to rockets had previously been carried out with the A-5, the small (25ft long) prototype of the A-4, which developed a thrust of 3,300 lb for 45 sec.

The addition of 75 sq ft of horizontal wing surface would not have converted the A-4 into a rocket aircraft. Take-off was precisely the same as for the A-4 in that the vehicle rose vertically before being eased into a 45-deg angle of climb. At the time of power cut-off (after about 60 sec), the wings would have no effect in the highly rarified atmosphere in which the rocket moved and it would then follow a ballistic trajectory. On the downward leg of the curve, however, air density would build up sufficiently for the vehicle to regain control (by virtue of its gyro-controlled aerodynamic surfaces) and to be pulled out of its dive. Whereas at take-off the rocket weighed 12.8 tons, it now weighed about four tons and could operate efficiently as a supersonic glider.

It was estimated that with the same A-4 type warhead, the bombardment range would have been increased from approximately 190 miles to approximately 370 miles, a distance which could be covered in 17 minutes. There is, of course, one big disadvantage in using winged rockets offensively in that, in order to obtain protracted flight, the approach velocity "on target" at the end of a slowly decelerated glide will probably be subsonic. The interception problem is thereby greatly eased.

Only one or two examples of the winged rocket were produced. In tests made during the winter of 1944-45, a first firing was unsuccessful because of premature power cut-off. The second A-9 operated satisfactorily, however, climbing under perfect control, and it was only after cut-off that the weapon started to tumble. Irregularity in the flight path at this time was accepted, because once the motor closed down the gas-vanes acting in the nozzle could no longer control the rocket, and the atmosphere was too tenuous for the aerodynamic surfaces to be of any use. However, the missile possessed "arrow stability" and, upon falling back into denser air, would regain the correct flight attitude.

In an attempt to improve the all-round stability characteristics, the project was passed to the Volkenrode establishment for a detailed aerodynamic study to determine a wing configuration with minimum travel of the centre of pressure over the whole speed range. A delta-wing layout was eventually chosen, but the war ended before development could proceed.

The delta-wing A-9 is bound up with another, more ambitious project known as the A-9/A-10 (Fig. 18): its object was nothing short of extending the range of the delta-rocket, launched from Europe, to the Atlantic seaboard of the United States.

The technique of launching one rocket from another in flight, as was proposed here, is known as the "step" principle. Several steps can be employed which drop off as soon as they exhaust their fuel and impart their impulse to the steps ahead. In this way, no dead-weight in the form of tanks, motors and rocket structure is carried a moment longer than necessary. An example of a step-rocket employing solid fuel is seen in Fig. 19. It was used on a limited scale by the Germans in the closing months of the war from Zwolle in Holland against Antwerp and, for a warhead of 88 lb, it had a range of approximately 140 miles.

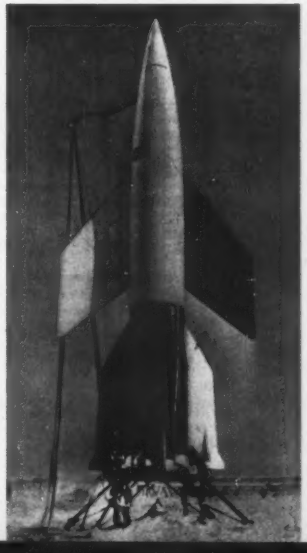

Fig. 17. The second—and only successful—A-9 on the launching table at Peenemunde, December, 1944.

* *"The German A-4 Rocket," Crown Film Unit.*

EVOLUTION OF THE GUIDED MISSILE ...

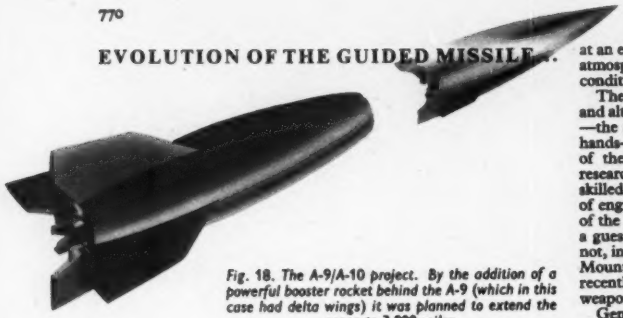

Fig. 18. The A-9/A-10 project. By the addition of a powerful booster rocket behind the A-9 (which in this case had delta wings) it was planned to extend the range to 3,000 miles.

TABLE I: ALTERNATIVE SCHEMES FOR GERMAN A-9/A-10 PROJECTS

Item	Scheme 1		Scheme 2	
	A-10	A-9	A-10	A-9
Gross weight (lb)	188,090	35,850	220,460	28,660
Individual step weight (lb) ...	152,240	35,850	191,800	28,660
Main propellant weight (lb) ...	11,470	26,260	136,700	17,640
				19,310†
Structure weight (lb)	37,470	6,615	55,100	8,820
				6,740†
Hydrogen peroxide and calcium permanganate (lb)	330	772	Nitrogen pressure feed	410
Payload weight (lb)	35,850	2,200	28,660	2,200
Exhaust flow (lb/sec)	*2,231	*276	2,728	260
				276†
Thrust at sea level (lb)	441,000	56,000	441,000	55,130
				60,000†
Length (ft)	45.5	46	—	46
Maximum diameter (ft)	13.5	5.4	11.5	5.56
Span over fins (ft)	29.5	—	—	—
Specific impulse (sec)	*198	*203	166	212 (218)†
Firing time (sec)	*50	*95	50	68 (70)†
Structural factor ϵ = structure weight / structure weight + fuel weight	0.246	0.197	0.288	0.318 (0.256)†
Mass ratio M_0 / M_t	2.56	4.07–10.42 effective	2.63	2.7–7.1 effective†
Velocity at "all-burnt" (ft/sec) ...	3,937	3,200	3,937	3.2–8.4 9,200
Altitude, "all burnt"	80,000ft	100 miles	80,000ft	100 miles
Range (miles)	—	3,105	—	3,105

*Figures extrapolated from existing data and in correlation with available information on these two schemes.

†Alternative schemes for A-9.

In the A-9/A-10 project, the extended range was to be achieved by providing the A-9 with a single 68-ton booster, intended to reach the "all-burnt" condition at an altitude of 80,000ft (Table I) and give the delta-rocket a starting velocity of 3,900ft/sec (2,660 m.p.h.). After the booster had been jettisoned, the A-9, continuing the climb, would reach a final velocity of 9,200ft/sec (6,260 m.p.h.) and, being then in highly rarefied atmosphere, would follow a ballistic curve. On the return to denser air, aerodynamic controls would terminate the dive at a height of 28 miles. The velocity would by then have risen to almost 11,700ft/sec (7,970 m.p.h.) and with this large amount of kinetic energy to dissipate, the gliding range was estimated at 3,000 miles.

As originally planned, the A-10 booster component was to use a nitrogen pressure system for feeding the propellants, but in a later conception turbo-pumps were substituted, which accounts for the alternative schemes specified in the table. Like the A-9 itself, the booster was stabilized by four gyro-controlled graphite vanes placed symmetrically around the exit of the venturi.

The four large fins on the A-10 were heavily braced to support the vehicle on the ground, and four long guide-members embedded in a flat concrete base entered stout vertical tubes, one in each fin. In addition to taking the compressive load, these would hold the rocket steady in the initial moments of take-off. The nose section of the booster was slotted to receive the delta-rocket, which was backed onto a thrust ring. Fully fuelled, the complete vehicle would weigh over 80 tons.

The A-10, incidentally, was supposed to be recoverable after use and incorporated air-brakes and parachutes of a special design which would open despite the rarefied condition of the atmosphere at the time they were brought into use. Each was to have double panels in its canopy, and the introduction of compressed air between these panels formed a kind of semi-rigid parachute independent of the prevailing air density. Thus, whereas normal-type parachutes would have been torn to pieces by the violent build up of pressure, the "self-inflating" canopy could be opened at an extreme altitude from which it gradually took effect upon the atmosphere, serving as a gentle brake for several miles until the condition of free fall was safely arrested.

The A-9/A-10 was in an early project stage at the war's ending and although it was claimed that, given another year, Peenemunde —the rocket research station on the Baltic coast, now in Russian hands—could have produced an experimental prototype, the scale of the undertaking was such that many years of preliminary research would have been necessary even with the equipment and skilled personnel available at the time. However, the masterpiece of engineering called "V.2" is sufficient testimony to the abilities of the German rocket scientists, and one would not like to hazard a guess as to whether large step-rockets of the type described do not, in fact, exist today behind the impenetrable screen of the Ural Mountains. The Americans, for their part—according to the recently published Stuart Report—do not expect to have such weapons before 1960.

Generally speaking, there are two methods to consider for the guidance of missiles over long ranges, the electronic system (variations of which have already been discussed) and the wholly automatic system. Of the two, the former is the more fully developed, but owing to its susceptibility to enemy counter measures, attention has returned to the automatic type of control, and attempts are being made to develop the inertial system, e.g., the technique used in the A-4 rocket. A likely method of improvement may be found in a telescopic device, pre-set to follow certain star patterns, whereby the inertial system may be monitored to maintain an accurate trajectory.

It had been further suggested that, for test purposes, the A-9 might be provided with a pressure-cabin and pilot and at the end of its flight be landed on a conventional undercarriage. The landing speed with empty tanks was estimated at 100 m.p.h. In such a project, we might at least have learned something about human reactions over a wide range of gravity. Not only would the pilot experience zero gravitation conditions over the free path of the trajectory but, of course, a severe induced "g" during the flattening-out of the dive. And added to his discomfort at this period would be a rather warm cabin; skin friction would produce a maximum local stagnation temperature of 7,000 deg K!

A similar, though in some ways even more drastic, technique was suggested by Dr. Saenger in his supersonic-bomber project. Here, on diving back into denser atmosphere, the vehicle was literally to bounce on the upper layers of air and, in being thrown upward again, to describe a kind of wave-shaped trajectory, much the same as that a flat stone will follow if ricocheted across water. Each plunge into the denser air would result in part of the kinetic energy being consumed, so that the initially long jumps would gradually become shorter, finally to be transformed into an even gliding flight.

These latter proposals are admittedly beyond the province of the present discussion, but they do show the nature of ideas that existed in Germany in 1945 on the question of long-range bombardment. It is known that copies of these design-studies fell into Soviet hands; and much of the German research equipment and hundreds of German technicians who had worked on missiles were moved to Russia. It would therefore be unwise to discount any one of these projects. Where development work is fed by huge sums and is given high priority in skilled manpower, and labour is so cheap that thousands of workers can be thrown in to build vast research establishments, test ranges and factories, the time normally reckoned (by our own standards) to produce these revolutionary weapons might easily be halved.

In this country, hard-pressed though we may be economically, it is vital that research be directed toward combating such advanced weapons. It is said that no method of attack can exist for which there is no effective counter measure. That may be so, but in the case of the supersonic missile, the means of attack is at the present time far ahead of the means of defence.

Fig. 19. The Rheinbote was a multi-step rocket; it is here seen on a mobile launching ramp.

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think the flying boat can never

equal the landplane

in performance

. . . . *how wrong they are!*

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CIVIL AVIATION

I.A.T.A. RESPONSIBILITIES

THE recent admission of the Spanish airline Aviacion y Comercio S.A., to I.A.T.A. has brought the total of that organization's member-companies up to 65. It is estimated that between them I.A.T.A. members now carry 90 per cent. of all scheduled international traffic. The new company is the second Spanish airline to join I.A.T.A., the Spanish long-distance carrier, Iberia, having been a member since 1945. In order to qualify for participation an airline must be licensed to provide scheduled air transport by a government eligible for membership of I.C.A.O.

Some proof of the measure of assistance which I.A.T.A. is affording to its members is reflected in the total of international traffic transactions put through the Clearing House in London during the first four months of this year: it amounted to some $48,404,000 and represented a substantial increase over the figure for the corresponding period of the previous year. By offsetting the credit and debit accounts of its airline members, the Clearing House was able to eliminate the need for cash payment and foreign exchange transactions on 82.3 per cent of the turnover for April. In one case a single airline's turnover for the month ($389,470) was offset by 99 per cent and the amount of the cash payment needed for complete settlement was only $3,914.

PILOTS ON STRIKE

WIDESPREAD disruption of domestic services in the United States was brought about last week by the walk-out strike of 900 pilots of United Air Lines. All the company's flights were suspended, with the exception of those connected with the Tokyo airlift. United is, of course, a particularly extensive operator and services to 68 different cities were affected. It is estimated that 600 flights had to be cancelled and that thousands of would-be passengers were stranded.

The strike was the culmination of a 22-month old dispute over wages and working conditions. One of the main issues concerns the pilots' claim for payment on a mileage basis; it is alleged that, with the faster DC-6Bs which are now being used, more flights have to be made for the same pay as was previously earned for flying in slower aircraft. The United States Mediation Board has called the strike an "illegal walk-out" and last Saturday President Truman appealed to the pilots to return to their duties so that the Board might continue its efforts to reach a workable agreement.

Although the president of United Air Lines, Mr. W. A. Patterson, has said that his company will not concede the mileage claim, the pilots were reported to have signified their willingness to return to work under a "truce" arrangement. At the time of going to press, however, no confirmation was available of any definite move one way or the other.

The American Airline Pilots' Association is known to have made similar demands to American Air Lines and T.W.A., and rumours were current to the effect that pilots of these two companies might also strike in sympathy with the U.A.L. personnel.

FROM DARKEST AFRICA

THE first report (recently published) of the newly formed Department of Civil Aviation of the Nyasaland Protectorate tells something of the manner in which the benefits of commercial aviation are being extended to even the most undeveloped parts of the world. Although a large part of the territory is uninhabited and its terrain of forbidding aspect, Nyasaland is now served on a regular basis by aircraft (Vikings and Doves) of Central African Airways Corporation and by the charter flights of the Rhodesian Aircraft Maintenance Service Co., Ltd. (Rapides and Bonanzas). In all, there are 12 airfields of which Blantyre is the main airport; last year a total of 5,789 passengers passed through the two main airports of Blantyre and Lilongwe. An attempt is being made, also, to arrange for a proportion of the mails to be diverted to air carriage in the near future.

P.A.A.'s LOSS

THE wreckage of the Pan American Airways' Constellation which had been missing for two days while on a flight between Accra (Gold Coast) and Roberts Field (Liberia) was discovered on Saturday on a hillside at Totota, 50 miles north-west of its destination. There were no signs of any survivors from the 31 passengers and nine crew who had been aboard.

The Constellation left Accra at 11.45 p.m. last Thursday and arrived over Roberts Field at 0246 hr on Friday morning. The weather was bad at the time and the pilot reported that he could not see the landing strip. The last message received was at 0330, when the aircraft should have had enough fuel for a further eight hours' flying. One member of the crew, the purser, was a Briton who had been employed by P.A.A. for 20 years.

WESTLANDS LOOK AHEAD

THREE design-studies of unusual interest—the work of the Westland Aircraft company—were revealed last week on the occasion of the first demonstration in this country of the S-55—itself the largest single-rotor machine to fly in England, and capable of carrying twelve passengers in its cabin and two crew in the cockpit forward and above. (Notes on the demonstration appear on p. 758.)

Of the design-studies, all with single rotors, the W-80 is a two-Leonides passenger machine representing thoughts on B.E.A.'s next probable requirement. It would be fast as these aircraft go, and might carry crew and 20 passengers.

However, it appears likely that this stage will be leap-frogged, and the larger W-81 is now receiving more attention. This 32-seater with two turbojet units has, in fact, reached the most advanced stage of the three in terms of design-work done. A top speed in the region of 150 m.p.h. with two Darts or Mambas is foreseen, and the gas turbines would be mounted side-by-side above the cabin and almost directly under the four-blade rotor.

For military or civil cargo-work Westlands are thinking along very ambitious lines, and they believe single-rotor machines of perhaps 200,000 lb a.u.w. are not so far over the horizon. The W-85, proposed and illustrated, would be in the 80,000-lb class with a 15-ton payload sufficient, say, for 100 armed troops in its military form. A rotor diameter of 110ft is required for this machine, and it is the only one which the company feels would justify the use of jets at the rotating-wing tips. Three large, or six smaller, gas turbines would provide the power, and rotor r.p.m. would be much the same as with present types.

Regarding the Westland-Sikorsky S-55, which in its Wasp single-engined form is primarily a military proposition, Westlands are studying variants which might be more attractive to commercial operators by virtue of their having two engines. The problem of finding a suitable British power source might also find a parallel solution. For example, should a double Leonides installation prove feasible in a modified nose, the resulting machine would presumably be more attractive to B.E.A. as a natural successor to their S.51s. The two-engine safety requirement would be met, and although the total output—900-1,000 h.p. —would be considerably higher than with the single 600 h.p. Wasp, S3H2 or S1H2, the airframe has the capacity to absorb it usefully. Certainly the accommodation of ten passengers in a roomy, well-situated cabin would be a great improvement on the present S-51 three-seat bench offered by the Corporation. The dimensions of the S-55 cabin are, in fact, length, 10ft; width, 5ft 6in; height, 6ft. With Wasp engine the useful load is 2,400 lb.

SHAPE OF THINGS TO COME: Three of the helicopter design-studies (described in the paragraph above) which have been evolved by the Westland Aircraft Co., are, for comparison, shown here beside the S-55, which had its first public demonstration last week. These artist's conceptions are (left to right) the S-55, W-80, W-81 and W-85.

CIVIL AVIATION . . .

AMERICA'S AIRLINE SAFETY

THE National Safety Council of America reports that last year saw the best safety record in the history of the U.S. airline industry. The 1950 figure for domestic operations was 1.1 fatalities per 100,000,000 passenger-miles. Forty-two companies received awards from the Council for having completed their passenger operations without a single fatality.

T.W.A. were particularly congratulated on having operated 4,420,434,000 passenger-miles with a perfect record between March 11th, 1947 and August 31st, 1950—only the second airline ever to exceed the 4,000,000,000 passenger-mile mark. The first operator to complete this number of passenger-miles without an accident was American Airlines.

United also had a perfect record throughout 1950, as did Colonial Airlines who had achieved an unblemished record of 367 million passenger-miles dating back to April 18th, 1930. At the end of 1950, also, Continental Airlines had logged some 473,250,000 passenger-miles without a fatality since May 1st, 1935. In addition, Hawaian Airlines completed 21 years of operation without a single fatality; seven other companies were also mentioned by the Council as having flown for more than five years without incident.

SPAIN FOR THE I.C.A.O. COUNCIL

SPAIN was, on June 18th, elected to fill the remaining vacancy on the 21-nation Council of I.C.A.O. Having been ousted from the organization in May, 1947, because of a United Nations' proviso that she could not remain a member of I.C.A.O. once she had been blackballed by the General Assembly, Spain was permitted to re-join I.C.A.O. last November when the United Nations lifted its boycott. She was then the only candidate for the vacant seat on the council. At last week's meeting in Montreal 29 votes were cast in favour of Spain's election to the council and none against. There were three abstentions and two blank voting papers were returned. Representatives of the remaining 22 member-nations were not present at the assembly. Señor Mariano de Turralde, the Spanish representative, has declared that his country "will now do everything possible to collaborate with I.C.A.O."

At its closing meeting, incidentally, the Assembly adopted a resolution pledging assistance to the United Nations on all matters directly affecting world security.

V.H.F. AND BROADCAST HARMONICS

FOLLOWING the request made some months ago by the Ministry of Civil Aviation for reports from airline radio operators and others that would assist them in tracing and remedying interference caused by broadcast transmitters, M.C.A. *Information Circular No.*77/1951, has been issued, thanking all those who gave information.

It is stated that the appropriate authority is now installing additional apparatus to deal with harmonics—the cause of the interference—and that the first phase of this work should be completed by about the middle of August.

Although existing harmonic-rejection equipment used in United Kingdom broadcasting transmitters fulfils international requirements, the new measures should reduce interference to small areas in the immediate vicinity of the stations. The fields existing in such areas, says the *Circular*, are so powerful that aircrews flying through them must still expect some interference.

U.S. JET TRANSPORT PROJECTS

DETAILS have been released of the Lockheed L-193 and Boeing Model 473 jet-propelled transports. These, as *Aviation Week* emphasises, are only "paper" aircraft, but it would appear that chances of military sponsorship have improved during the past few months.

In configuration the L-193 is almost a scaled-up F-90 penetration fighter. Four turbojets, each of 12,200 lb thrust, are installed in a "battery" or "cluster" well aft, as indicated in the drawing on this page; this arrangement is claimed to effect a marked reduction in cabin noise level. Leading particulars of the L-193 are: span, 104ft; length, 112ft 2in; wing area, 1,615 sq ft; height, 36ft 8in; number of passengers, 48-64; gross weight, 148,000 lb; max. landing weight, 113,000 lb; max. cruising speed at 20,600ft, 618 m.p.h.; max. cruising speed at 35,000ft, 564 m.p.h.; rate of climb at sea level, 5,500ft/min; C.A.R. take-off field length, 5,050ft; C.A.R. landing field length, 4,980ft; landing speed at max. landing weight, 120 m.p.h.

It will be judged from the drawing that the Boeing 473 embodies features of the Stratojet bomber and Stratocruiser airliner. Four turbojets of 8,250 lb static thrust are envisaged. Other data are: span, 140ft 2in; length, 111ft 11in; wing area, 2,300 sq ft; gross weight, 135,000 lb; gross landing weight, 120,000 lb; passengers, 60-97; max. speed at normal rated power at 40,000ft, 580 m.p.h.; cruising speed at 40,000ft, 500 m.p.h.; rate of climb at sea level, 3,600ft/min (rated power); C.A.R. take-off-field length (without liquid injection), 3,950 ft; C.A.R. take-off-field length (with water injection), 2,850ft; C.A.R. landing-field length at 112,000 lb (brakes only), 6,150ft; C.A.R. landing-field length at 112,000 lb (brakes and tail parachute), 5,050ft; stalling speed at 112,000 lb, 95 m.p.h.

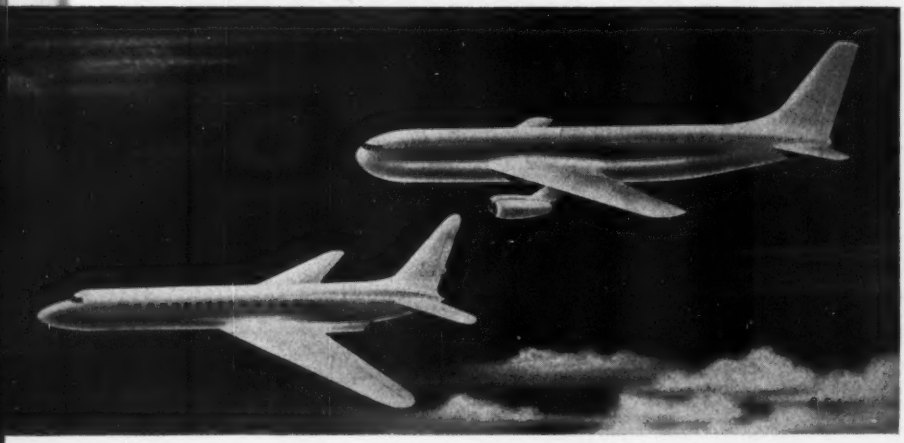
THREE-CLASS TRAVEL FOR K.L.M.

IT would seem that K.L.M. will be the first European airline to introduce three distinct classes of passenger accommodation for air travel. The Super Constellations and DC-6Bs now on order and which, world conditions permitting, will be delivered in 1952, are to have seats mounted on rails to facilitate variations in the spacing arrangements for the different standards of comfort selected by passengers.

The DC-6B will accommodate 37 first-class passengers, 50 second-class or 73 third-class; the larger capacity of the L-1049A will permit it to carry 48 first-class, 64 second-class or 84 third-class passengers. In addition, all the seats will be easily removable for conversion of the aircraft to freighter duties.

K.L.M. state that, in the light of their past experience, the accommodation space on these aircraft will not be wasted on non-essential luxuries such as cocktail bars; rather, the company will concentrate on providing extra toilet and powder-room facilities, which are considered more necessary for passengers flying over long stage-lengths.

The nine Super-Constellations which K.L.M. have ordered will be used on the North Atlantic routes via Prestwick and Shannon.



REDUCING THE GAP: Under the threat of British competition, American manufacturers and operators—according to a recent report—are now achieving some success in their efforts to advance the priority of jet transport construction in the United States. The two design-projects shown here (and described above) are expected to be included in a military development programme now under consideration. The design of the Lockheed L-193 (left) is broadly based on that of the F-90 fighter by the same constructor; similarly, the Boeing 473 (right) bears more than a trace of the lines of the B-47 bomber.

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CIVIL AVIATION . . .

BREVITIES

THE Minister of Civil Aviation, Lord Ogmore, visited Paris last week to see the 19th Salon de l'Aéronautique. He was entertained at a luncheon given by the British Ambassador, Sir Oliver Hardy, to enable him to meet some of the leading authorities in French civil aviation. At Le Bourget, also, he was the guest of honour at a lunch given by the Conseil de l'Administration de l'Aéroport de Paris.

* * *

The K.L.M. DC-4 which has been acting as sea-transport to the Austin A40 car whose drivers have circled the world in 21 days arrived at Prestwick, with the car on board, on June 21st. Capt. J. J. Bak was the pilot.

* * *

B.O.A.C. has arranged what is, in effect, the longest charter flight in the company's history. A round trip of nearly 25,000 miles will be logged by a York flying a ship's crew from London to Melbourne and returning with another load of seamen. The aircraft left London on June 20th and is due to complete the 25,000 miles by July 5th.

* * *

The Scandinavian Airlines System has announced its intention of introducing low-cost tourist class flights on the New York-Scandinavia route from October 1st, 1952. The service will be operated by DC-6Bs, converted to accommodate 80 passengers (as compared with 69 in the normal versions).

* * *

The first attempt to receive a television transmission aboard a trans-Pacific airliner recently succeeded on United Air Lines Flight 49, bound for Hawaii from San Francisco. Reception at 20,000ft was found to be perfect for 250 miles west of the point of departure.

* * *

An airlift which has already taken to Israel some 98,000 Jews who have renounced Iraqi nationality is expected to end this month, when a further 9,000 persons have been transported. The aircraft, operated by the American-owned Near East Transport Company, has been keeping up a daily passenger total of 700 during the last three months.

* * *

Following the recent survey visit to Cocos Island, the Australian civil aviation authorities have reported that the airstrip on the island will have to be completely rebuilt before large aircraft can use it. The survey was made in connection with a plan to use Cocos as a stopping point on a proposed route from Australia to South Africa.

* * *

For the third year in succession, A.N.A.'s "Air Beef" scheme has begun its four-month season of operation. The air side of the arrangements at Glenroy, where the inland abbatoirs are located, have again been placed under the personal supervision of Mr. Ian Grabowsky, the company's planning and development manager, who is to investigate the possibilities of establishing further abbatoirs. Last year nearly 4,000 head of cattle were killed at Glenroy; this season's killing is expected to be considerably larger.

PARIS EXHIBIT: An outstanding feature of the Ministry of Civil Aviation's display at the Paris Salon is this 15 x 8ft model of London Airport, executed to the minutest detail on a scale of 1:1,250ft. In addition to giving some idea of how the future central terminal area will appear when completed, the model also shows the four phases of lighting which are brought into operation in varying visibility conditions.

The New Zealand Minister for Air, Mr. T. L. McDonald, arrived in London from Sydney last week on a brief visit to this country. He was welcomed at the airport by Mr. W. T. Jordan, the New Zealand High Commissioner in London.

* * *

President Truman has announced the appointment of T.W.A.'s well-known chairman, Mr. Warren Lee Pierson, to be the United States representative on the Tripartite Commission on German debts, with the personal rank of ambassador. Mr. Pierson is an expert on international law and finance, and has served as advisor to the U.S. Government on many important matters; he will continue to hold his post as chairman of T.W.A.

* * *

On its fifth overseas development flight, made last week, the D.H. Comet called for the first time at Nice and Malta. These flights are part of the programme to investigate air-traffic control and operating techniques before the aircraft is introduced into regular service on the Corporation's routes later this year. In October, incidentally, the Comet is expected to make a trial flight on the London-Sydney route, and work is already going ahead at Kalang airport (Singapore) to extend the runway.

* * *

P.A.W.A. have inaugurated a daily "President" service, using Stratocruisers, between London and New York; the Paris/New York "President" flights were also stepped up to a daily frequency with effect from June 15th. Extra-luxurious amenities are being provided on what is known as the "President Special" flights, which are to be introduced on the route to New York once weekly from London and twice weekly from Paris and Rome.

CLUB AND GLIDING NEWS

THE fourth international rally to be organized by the Aéro Club de Basse-Normandie (which took place at Flers de l'Orne during the week-end of June 16th-17th) proved fully as popular as in previous years, despite the low cloud over the Channel which prevented five of the British competitors from turning up. Those who did reach Flers, however, were rewarded by two entertaining days, well filled with receptions, official dinners and pleasant excursions to interesting parts of the neighbourhood.

First in order of merit, as shown by marks awarded, a British participant, Mr. V. A. Ercolani, flying a Gemini, who thereby qualified for the Chamber of Commerce Cup and the Escadrille de Cedres Challenge Cup for the longest flight to the rally. Mr. Ercolani had flown from Spain, where, from June 8th to 15th he had been attending the Spanish International Rally. Second was M. Querez (France), flying a Sipa, followed by Mr. J. V. Heriz-Smith (British) in an Auster.

Among the British participants, incidentally, was a veteran enthusiast, Dr. A. P. Thurston, who never fails to miss this event.

ENCOURAGING for those who sometimes wonder how long it takes to learn to fly: The news that a young member of the Strathtay Aero Club, Mr. J. C. Henderson, after making his first solo flight at Perth after only three hours dual, completed (with above average assessment) the entire course of flying and ground training for a Private Pilot's Licence in less than three weeks. He subsequently reported for National Service and was selected for pilot training in the R.A.F.

The club is now quite busy with a number of new pilot members who are hoping to qualify shortly. In May, incidentally, one of the three pilots to gain their licences was a woman, Miss Morrow, who is now continuing her training to obtain an instructor's endorsement.

In spite of the fact that only 17 days of May were suitable for instructional work, the Strathtay club logged a total of 137 hr. during the month.

CONTESTS for the Swiss national championships for powered aircraft, organized by the Grenchen section of the Swiss Aero Club, are due to begin today, June 29th; they will include precision landing and formation flying contests. From August 13th to 18th the Swiss Aero Club is holding a Jubilee week at the airport of Saanen; this will coincide, incidentally, with the Second International Air Tour of Switzerland (August 12th to 18th) in which Saanen will be one of the points visited.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Is this the Limit?

I WOULD like to quote from a brochure which I obtained at the Douglas stand at the Paris Aero Show. After a reference to the Boston, the following appears :—

"An interceptor version they (the British) called the 'Havoc' played a successful rôle in helping to bring to a halt the devastating night air raids on London that history has labelled the 'Battle of Britain.' It was the exploits of these and other British-flown aircraft that evoked from Churchill that epic phrase, 'Never have so many owed so much to so few.'"

Chalfont St. Giles, Bucks. R. PRIZEMAN.

Air Displays and Public Safety

YOUR correspondent who questions the advisability of high-speed, low-altitude demonstrations at air displays may (as your editorial footnote suggests) be writing from practical experience as a pilot; but is the risk so great as he implies it to be?

During some 20 years' connection with aviation I have never seen anything that even looked like approaching the kind of calamity he apparently envisages. Moreover, I only remember hearing of one case—in Spain, I think it was, before the war—in which spectators were killed by an aircraft landing among them.

In the aggregate, hundreds of displays must have been held during this time, thousands of pilots must have taken part in them, and hundreds of thousands of spectators must have watched them.

Does not this suggest that the risk is not even comparable with that involved in crossing the road?

Shoreham, Sussex. LOOKER-ON.

IN the Correspondence columns of last week's issue C. Olde Sweat, Esq., asked a number of questions anent "dirty darts" by the more rapid aircraft at air displays. He has stated an unease I have felt for a long time. Jet aircraft may be somewhat simpler to fly than corresponding piston-engined types, in that the pilots are not worried by torque stalls and the like, but the way in which our jet fighters have been demonstrated at displays during the past few years has undoubtedly tempted Providence to no mean tune. Sooner or later, something will come unstuck, and a few tons of airframe, elbowing through the crowd at 300 or 400 m.p.h., may occasion a certain amount of despondency about the whole business.

Aside from this quite mundane assessment of the matter, the more hectic antics are unnecessary. There isn't much doubt that straight and more or less level fly-pasts or fly-overs by the quicker jets are extremely impressive and are reasonably safe, even when done at tens of feet instead of hundreds. It is, of course, the high-speed sinuous flight at really low level which is dangerous, for everything conspires against the pilot being able to take instantaneous avoiding action if anything goes awry. At least in straight flight the pilot is right way up and has no g effect to contend with, and a slight rearward movement of the pole is enough to rocket him up a few hundred feet to gain a bit of time—and space.

In any case, sheer speed is best illustrated by the straight, low fly-past, and aerobatics best shown at upwards of about 1,000 to 1,500ft, where the viewers' angle of vision embraces a wider field. One realizes that the public at air displays like to see—even, nowadays, expect to see—jet aircraft, but let it be admitted, the glamour attaches to noise and speed, and these qualities are admirably conveyed by the straight fly-past. The more knowledgeable spectator, who appreciates the manoeuvrability of a modern fighter, is quite prepared to watch the aircraft perform at a reasonable altitude; the man in the street doesn't care.

Incidentally, just *what* does your correspondent mean by "We roared as one man when the aircraft, one wing tip still vertically above the other, slid skilfully to a wavering standstill in front of the V.I.P.s' enclosure"? This aircraft must have had a very remarkable c.g.

London, W.1. BARRIE ALDBURY.

TRAINING-AIRCRAFT SHORTAGE

SOME possibly unwelcome changes and reallocations of aircraft are soon to take place in the R.A.F.V.R. The reason given is that training requirements within the R.A.F. proper—among others, it is believed, the decision to give flying courses to National Servicemen and to expand training overseas—have absorbed Chipmunks which might otherwise have been allocated to the V.R. As it is, the University air squadrons are all to have Chipmunks, even though some of them will have to be withdrawn from Reserve flying schools which have already been re-equipped with them. An even distribution of all available Chipmunks will then be made among the R.A.F.V.R. schools, and this will entail withdrawing some from schools already flying Chipmunks in order to equip other schools which to date fly only Tiger Moths. Both types will thus be found in the majority of Reserve flying schools. Any Chipmunk written-off as a result of an accident will be lost to the Command and will be replaced with a Tiger Moth.

Four Reserve schools—Derby, Doncaster, Desford and Sywell—are to be equipped with Prentices in the near future as soon as these basic trainers become available from the R.A.F.

The Ultra-Light and Civil Defence

ALLOW me to refer to the editorial statement (p. 689, June 15th) expressing your disbelief that ultra-lights (mentioned in the Air League's Memorandum on "An Air Wing for Civil Defence") could do the work, "even in fine weather". With due respect to editorial wisdom, there is no justification for such a presumption, and I challenge you to have a try before passing judgment.

I am certain that if you were to have a go on a practical ultra-light aircraft, e.g. the Dart Kitten, you would be compelled to admit that ultra-lights are just what is needed for the Civil Defence organization, and for the Home Guard too.

The tasks of Civil Defence (and also those of the Home Guard) will be materially helped neither by present-day helicopters nor by modern "light" aircraft. Neither of these organizations will, in an emergency, be able to afford aeronautically skilled mechanics, pilots trained as speed merchants, or material or equipment needed by Army and R.A.F. What they require are robust aircraft which are easy to maintain, to repair, and to store, and which are safe and effective in the hands of the lame, halt and blind amateur with little if any flying experience; aircraft which can be, if necessary, crash-landed with certainty of survival for crew and vital equipment; aircraft which lay no claim to scarce materials or equipment.

From the response to a memorandum issued by the Ultra Light Aircraft Association on the matter, it is obvious that the Powers That Be are becoming aware of possibilities inherent in this category of aircraft.

It is absurd to say that ultra-light aircraft can be operated in fine weather only. Apart from restrictions which are (wisely) imposed by A.N.R., practical aircraft of this category can be safely operated in any weather, excepting howling gales and thick fog. Lord Sempill, and Mr. H. A. Taylor (*alias* "Indicator," who in former years "collected" ultra-lights as a hobby for assessment in *Flight*) could tell you something about operational applicability. In fact, Civil Defence may discover that only ultra-lights will be able to cope with conditions to be expected after incidents of the future.

A. R. WEYL, A.F.R.Ae.S.
Chairman, Research Sub-Committee, Ultra Light Aircraft Association.

London, W.1.

[Mr. Weyl defends his pets with characteristic vigour. The Editor has flown, *inter alia*, the Chilton, Aeronca, Tipsy and Fairey Junior and, while appreciating their many good and sporting qualities, requires to be convinced of their advantage over slightly heavier but still very simple machines for such jobs as those the Air League envisages; it seems that they would be required to work in all kinds of weather and in some cases be equipped with radio and have the capacity to carry emergency supplies.—ED.]

FORTHCOMING EVENTS

June	30-	R.Ae.C.: Members' Deauville Rally.
July	2.	
July	1.	International Rally, Savona, Italy.
July	4-11.	F.A.I. Committee Meetings, Brussels.
July	6-9.	Bienne Aviation Club: "Swiss Watch" Rally.
July	7.	Aéro-Club de Savoie: Aix-les-Bains Rally.
July	7-8.	R.Ae.C.: Members' La Baule Rally.
July	7-8.	International Wakefield Cup Model Contests, Finland.
July	14.	Bristol Corporation: Air Race Meeting.
July	14.	S.M.A.E. Festival of Britain Model Championships, Wembley.
July	15-22.	Aero Club of Italy: International Air Week.
July	16-21.	Conference on Automatic Control, College of Aeronautics, Cranfield.
July	18-22.	R.Ae.C. and Yorkshire Aeroplane Club: International Rally.
July	19-21.	*Daily Express* and R.Ae.C.: International Rally and "Fifty Years of Flying" Display and Exhibition, Hendon.
July	22.	Luton Flying Club: "At Home" (sponsored by A.B.A.C.).
July	22-29.	National Gliding Championships, Camphill, Gt. Hucklow, Derbyshire.
July	27-29.	Royal Netherlands Aero Club: Ypenburg Display.
July	28.	Royal Engineers' Flying Club: Air Day, Rochester.
July	29.	Columbus Centenary Rally, Genoa.
Aug.	4-5.	Aéro-Club de Touraine: International Rally, Tours, France.
Aug.	6.	*Daily Express* Challenge Trophy International Air Race, Shoreham Airport, Sussex.

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SERVICE AVIATION

Royal Air Force and Naval Aviation News

EXTRA URGE: A Sea Fury making a rocket-assisted take-off from the flight deck of H.M.S. "Glory," now in Korean waters. Since this carrier took over from H.M.S. "Theseus" last April, nearly 1,000 sorties have been flown from her deck.

Lord Pakenham on Naval Aviation

AT his first Press conference as First Lord of the Admiralty last week, Lord Pakenham dealt exclusively with matters and news concerning Naval Aviation.

He announced that H.M.S. *Eagle*, the Navy's newest and largest aircraft carrier, is due to commission in October, and that the squadrons operating from her decks will be equipped with Attackers. Deck landing trials with the Sea Venom, he said, would be held in the *Illustrious* in July and it was hoped that these aircraft would come into operational use in 1952.

In dealing with aircraft he announced "Gannet" as the new name for the Fairey 17. (It is to be hoped that none of them will follow the practice of their namesake, which folds its wings and dives vertically into the sea to secure its prey. Another name for the Gannet is the Booby.) The Fairey 17, incidentally, is not the first aircraft to be named Gannet; in 1923 there was a little Gloster light plane of the same name. The First Lord said that the main reason for the choice of the name was that the anti-submarine station at Eglinton, Northern Ireland, was called H.M.S. *Gannet* and that great confidence reposed in the Fairey 17 as an anti-submarine aircraft.

Lord Pakenham then told the conference that there was no truth at all in the reports of sabotage on board H.M.S. *Glory*, our carrier in Korean waters. The contamination of the ship's aircraft-fuel store had been caused entirely by corrosion in the pipelines of the refuelling ship.

Two other news items given at the conference were that Machrihanish, Kintyre, is to reopen to accommodate training squadrons to give refresher courses, and that it was the Admiralty's intention to send a helicopter unit of two Dragonflies to operate in Korean waters.

The most important subject of the conference was the announcement of a plan similar to that already in being in the R.A.F., whereby National Servicemen accepted for training as officer aircrew are invited to transfer to a short full-time service engagement of four years. Those who so engage will receive full naval rates of pay—this will mean an extra £82 per annum—and a gratuity of £525 at the end of four years. On completion of the four years service they may volunteer for a further four years, during which the gratuity will continue to grow at the same rate of £175 for each year. In this second period volunteers will be considered for permanent commissions in the Royal Navy.

Lord Pakenham described the shortage of aircrews as "the most acute of all our problems" and said that not enough of the regular officers are volunteering to serve in the air branch, neither were enough coming in under the eight-year short-service scheme introduced in 1948. In reply to questions, it was emphasised that service in Naval Aviation does not prejudice a naval officer's chances of promotion to the highest rank.

PICKING UP IDEAS? Air Chief Marshal Sir Hugh P. Lloyd (extreme right), A.O.C.-in-C. Bomber Command and president of the R.A.F. Model Association, watches M. A. Ayres prepare his radio-controlled model for flight at the Northern Heights Model Flying Club's Gala, held at Langley airfield last Sunday. "Flight" photograph

New Commandant for C.F.S.

WITH the acting rank of air commodore, G/C. A. D. Selway, D.F.C., has been appointed commandant of the Central Flying School. He replaces G/C. G. T. Jarman, D.S.O., D.F.C.

Sycamore Tropical Trials

A BRISTOL Type 170 Freighter, carrying a Bristol Sycamore (the Service name for the Type 171 helicopter) arrived at Khartoum on June 22nd. The Freighter was flown by a Ministry of Supply crew and was delivering the Sycamore for tropical trials, which are expected to last for two or three months. The flight from Lyneham took two days, and calls were made at Marseilles, Malta, El Adem and Waddi Halfa.

Re-equipping R.N.V.R. Squadrons

THE three fighter and two anti-submarine squadrons of the Royal Naval Volunteer Reserve are shortly to receive more modern aircraft.

At present the fighter squadrons—No. 1831 (Lancashire), No. 1832 (Berkshire) and No. 1833 (Warwickshire)—have Seafires, but it is hoped that re-equipment with Hawker Sea Furies will begin in August. Already the squadrons have two-seater trainer Sea Furies for pilot conversion.

The two anti-submarine units, Nos. 1830 and 1840, are to have later-mark Fireflies than those already in use. No. 1830, based at Donibristle, will exchange Mk 1 for Mk 5 or 6; No. 1840, which recently formed at Culham and is now stationed at Ford, Sussex, has been temporarily given Firefly Mk 4s.

Appointments

THE AIR MINISTRY has announced that A. Cdre. the Earl of Bandon will take up his appointment as A.O.C. No. 11 Group, Fighter Command, on July 5th. He will have the acting rank of air vice-marshal.

The Earl of Bandon's post as A.O.C. No. 2 Group, B.A.F.O. will be taken over by G/C. H. D. McGregor, C.B.E., D.S.O., who will assume the acting rank of air commodore. A.Cdre. McGregor comes from New Zealand and until lately held an appointment with the Standing Group of N.A.T.O.

G/C. J. E. R. Sowman, until recently Senior Equipment Staff Officer at Flying

SERVICE AVIATION . . .

Training Command, has been appointed to a similar post at H.Q. M.E.A.F. He will have the acting rank of air commodore.

In Naval Aviation, Captain W. T. Couchman, D.S.O., O.B.E., R.N. is to succeed Rear Admiral E. W. Anstice, C.B. as Flag Officer Flying Training.

For the past year Capt. Couchman has commanded H.M.S. *Gannet*, the air station at Eglinton. He is a qualified pilot and was in command of H.M.S. *Glory* in 1946 before becoming Director of Naval Air Organization and Training in 1947.

In his new appointment he will have the acting rank of rear admiral.

"Flight" photograph

G/C. E. G. WATT, who led the successful Fighter Command team at the recent R.A.F. S.A.A. Bisley meet.

"Flight" photograph

AFTERNOON OFF-DUTY: Sir Hugh and Lady Walmsley receiving their guests at a garden party given by the A.O.C.-in-C. and officers of Flying Training Command H.Q., at Shinfield Park, Reading, on Wednesday of last week.

Sir Keith Park on the R.N.Z.A.F.

ACCORDING to Press reports, Air Chief Marshal Sir Keith Park, speaking in Auckland on Thursday of last week, described the Royal New Zealand Air Force as being "in a parlous state." He added "The Government might be asked to give support to the aero clubs by providing work directly connected with national defence, such as training at remunerative rates so that they could at least remain in being."

Sir Keith, during the war, held the appointment of Allied Air Commander-in-Chief in South-east Asia.

Brigands Grounded

OWING to a number of accidents that have recently occurred—there have been three in the last three weeks—all the Brigands operating against the bandits in Malaya are grounded until further notice. No announcement has been made as to the cause of the mishaps.

Orenda—Canuck Flies

THE first Avro Canuck CF-100 long-range, all-weather fighter to be powered with Orenda turbojets (the prototypes had Rolls-Royce Avons) flew for the first time on June 20th. Mr. Don Rogers, the pilot, said after the flight, "The twin Orendas bring out the CF-100's best and most powerful performance characteristics." Production for the R.C.A.F. is under way. A photograph and details appear on page 756.

New R.A.F. Camouflage

NEW camouflage schemes, varying according to the class of aircraft concerned, have been approved for the R.A.F. and are gradually being introduced.

Medical Technician Branch

AIRMEN with the necessary qualifications serving in the medical and dental trades of the R.A.F. are now eligible for commissions in the newly formed R.A.F. Medical Technician Branch. All candidates are required to hold relevant civil professional qualifications and special leave may be granted to likely candidates in order that they may study and qualify.

Airmen must be between the ages of 35 and 40 years and will be commissioned as flying officers.

Pilots for the Queen's Squadron

NO. 600 (City of London) Squadron, R.Aux.A.F., of which the Queen is the Hon. Air Commodore, has a limited number of vacancies for National Servicemen as pilots; pre-selection as a pilot for No. 600 Squadron virtually ensures the candidate obtaining a commission.

Before the war pilots came to the squadron mostly from Lloyds and the Stock Exchange and were taught to fly. Now, because of the greater complication of modern aircraft and of flying generally, only pilots already trained can be accepted. While this has complicated the intake of pilots it does give others the opportunity of being commissioned in this unit.

No. 600 is the senior R.Aux.A.F. Squadron, and its associations with the City of London are as closely linked now as they have been during the whole quarter of the century of its existence. For a town headquarters the squadron shares Finsbury Barracks with the Honourable Artillery Company.

Wallis Trust Fund

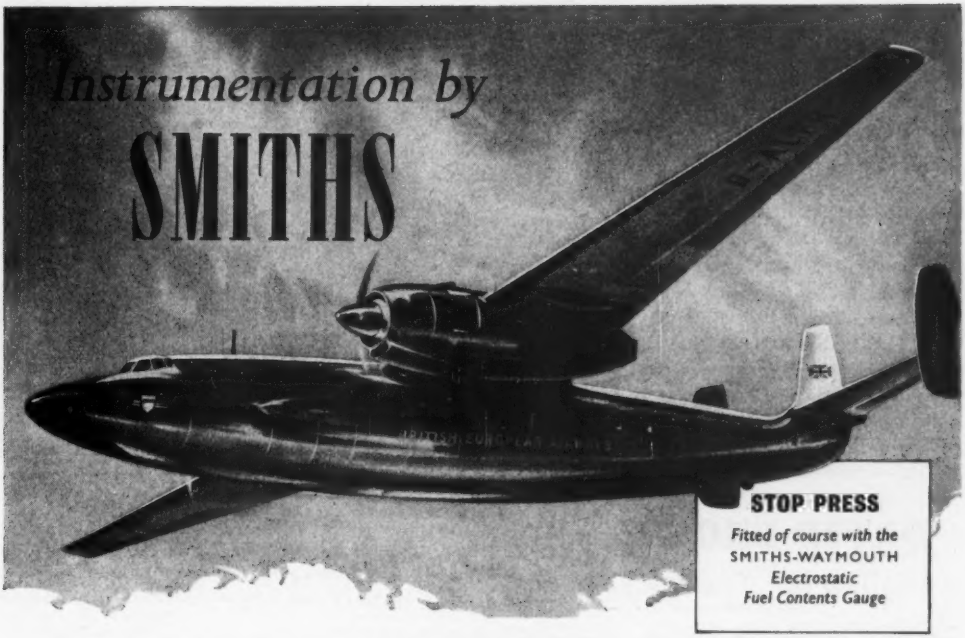
THE inventor of the special mines used by the R.A.F. to destroy the Möhne and Eder dams in 1943, Mr. B. N. Wallis, is to devote to the education of children of R.A.F. men the entire proceeds of the £10,000 award which he received.

The money will be used to set up an educational trust at Christ's Hospital in conjunction with the R.A.F. Benevolent Fund.

Cadet Exchange

AS part of the international exchange scheme, 51 Canadian Air Cadets have been chosen to tour Britain and the United States. Fifty cadets from the United Kingdom, plus one each from Norway, Sweden, Holland and Denmark, will tour Canada as the balance of the exchange.

FOR H.M.S. "EAGLE"? Production Vickers-Supermarine Attackers being prepared for flight-testing. Note the new dorsal fin which is now standard.



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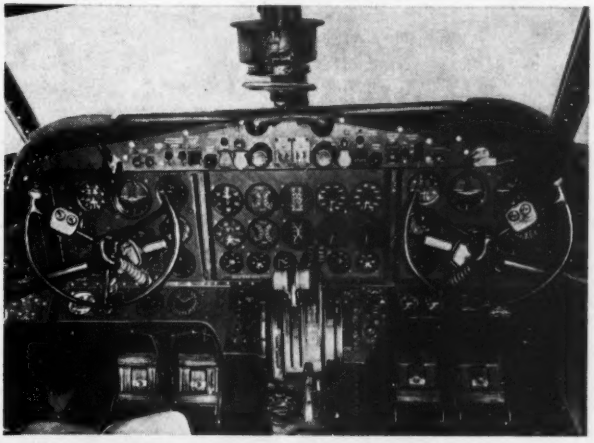

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JET AIRLINERS IN SERVICE

A Canadian Audience Hears Three Informative Lectures on a Topical Subject

FROM June 11th to 15th, the first 1951 semi-annual meeting of the American Society of Mechanical Engineers took place at Toronto, and among the papers presented before the Engineering Division, Aircraft, were three of more than ordinary interest. Mr. W. G. Townley (general manager of operations, Canadian Pacific Airlines) spoke on *Turbojet Transport with Special Reference to the Comet*; Mr. E. H. Atkin (chief designer, A. V. Roe Canada, Ltd.) discussed *Turbojet Aircraft with Special Reference to the Jetliner*; and Mr. B. H. Slatter, experimental flight engineer, Armstrong Siddeley Motors, Ltd., spoke on *The Mamba Engines in the Apollo Aircraft*. Abstracts of the three papers follow.

THE view of the aircraft operator was propounded by Mr. Townley, who said that it was the intention of Canadian Pacific Airlines to operate the Comet initially on their North Pacific route originating in Vancouver and terminating at Tokyo. The optimum cruising altitude of a turbojet aircraft was so high that it became impractical to consider operation between any two points separated by less than 1,200 n.m. The Orient route had been chosen for this reason and also because of the generally lower ambient air temperatures which applied, and the adequate runway lengths and navigational facilities at the points of call.

The lecturer then briefly described the aircraft, and went on to say: "The Comet is a simple airplane. This short statement of fact embodies significance of a magnitude which I am sure is not as yet fully appreciated by the industry."

On the score of meteorology, Mr. Townley observed that data concerning wind and temperature at the Comet's operating altitude of 40,000ft were not available for all areas of the world, and in some others the accuracy or quantity of observations was not to the desired standard. C.P.A. were not unduly concerned with jet streams and other upper air phenomena, and there was no apparent reason for alarm over meteorological circumstances which applied at these altitudes.

Traffic-control and Navigation

Of air-traffic control and navigation in relation to the Comet, the lecturer said that the low traffic-density of the airports on the Orient route would give the company sound experience without the difficulties encountered at the more congested points. C.P.A. favoured a let-down starting at, say, 300 miles from the destination, with a prolonged descent of 500 to 700ft/min at a constant I.A.S. of 220 kt. The main navigational problem was the reduction of time required to obtain position, and considerable progress had been made toward this end. Any further improvement was, however, mainly dependent on the development of instruments for recording data and performing calculations automatically. Pressure navigation would be limited to the single-drift technique, firstly because insufficient upper air data were available for the construction of reliable forecast charts at flight level, and secondly because the greater the aircraft's speed the less the gain to be derived from following any track other than a Great Circle. Navigational instruments would include periscopic sextant, air-position indicator, radio altimeter, Loran and, possibly, D.M.E. and omni-range equipment.

Of performance, Mr. Townley stated that the penalty involved with full-throttle operation of the Comet below the 30,000ft cruising level amounted to an increase in the specific fuel consumption of 7½ per cent for each 5,000ft below that level. For a 1,000ft decrease in altitude below the stated level, there was a 1¼ per cent decrease in air miles/lb. Add to these figures the increase in fuel consumption for a possible icing condition, and it was very clear that precise *en route* control was an absolute necessity.

So far as C.P.A. could see, there were no particular snags in airframe and engine operation and maintenance. A 2 per cent loss in power during the period between engine overhauls, accompanied by a 2 per cent increase in fuel consumption, was expected; power variation between production engines might be about 4 per cent. Refuelling the Comet would pose some problems, mainly because of the large quantity involved, i.e., 7,050 Imperial gallons (57,105 lb).

There were now as many specifications for jet fuel as there were types of jet aircraft. The British staunchly supported pure kerosene, the Americans specified a "souped-up" kerosene obtained by adding quantities of the more highly volatile petroleum fractions, while the Canadian specification lay between the two extremes. The British specification retained the safety of the kerosene high flash-point and low vapour pressure, but had the high freezing point of —40 deg F (—40 deg C). The American specification lost somewhat in the safety feature, but lowered the freezing point to —58 deg F (—50 deg C), which was important in view of the low ambient operating temperatures. De Havillands offset this point by stating that the mass of the fuel was so great, and the flight time so short, that the fuel never reached the lowest ambient temperature so far encountered, —67 deg F (—55 deg C). The addition of the more volatile fractions increased the vapour pressure which, if the trend continued, would require pressurization of the tanks. Another minor point worth noting was that kerosene was less hygroscopic than high-octane fuels, and the possibility of entrained ice particles was increased with the American specification. Accurate fuel quantity and fuel flow instrumentation was mandatory, since these were critical operating factors. To date, experience with electronic fuel-measuring devices had not been too satisfactory, and now the effect of extremely low temperatures would be added to the long list of variables. The fuel flow instrumentation would have to be a mass measuring device, since B.Th.U./lb was the governing factor.

Turning to pressurization, Mr. Townley thought that explosive decompression should not be a problem of consequence if the original design-philosophy had been properly applied. De Havillands took the view that the window installation, for example, should be relatively as strong as the wing spar, in that neither should fail under foreseeable operating conditions. One did not worry about the wing collapsing—one should therefore have no worries about the windows blowing out. The atmosphere at 40,000ft was very dry, and the Comet had a humidifying method whereby water was sprayed into the cabin air during the re-circulation cycle. Ten gallons should be adequate for a six-hour flight. Refrigeration might be necessary in some latitudes, but only to an altitude of 20,000ft, since above this, the low ambient temperature should make it unnecessary.

Economic Advantages

Under the heading of economic considerations, Mr. Townley suggested that the principal economic advantages to be gained through the Comet would be (a) the substantial increase in utilization due to the speed—this increase would be in almost direct proportion to the speed, and one Comet would do the work of two Canadair Fours; (b) a major reduction in maintenance costs, due to reduced vibration and to the simplicity of the basic design. These factors had been estimated to effect an overall saving of from 10 to 20 per cent.

In the first year of Comet operation, C.P.A. did not anticipate a reduction in their present operating-cost level, in that the initial Ghost overhaul period would be 500 hr for the first year, which would approximate the company's present Merlin 626 and P. and W. R2000 experience. In the second year, however, they anticipated a Ghost overhaul period of 800 hr, which would surpass the present R2800 engines. Subsequent to the usual "learning" period, it was felt that the forecast economies might be realized by the experience in hand and by the engine improvements now being type-tested by the makers. C.P.A. believed that the Comet would be improved in range, speed and power through steady development by de Havillands, and that it would adequately meet C.P.A. requirements for the next ten to twelve years.

THE CONSTRUCTOR'S VIEW

COMPLEMENTING Mr. Townley's paper, the view of the aircraft manufacturer was propounded by Mr. Atkin in *Turbojet Aircraft with Special Reference to the Jetliner*.

A requirement for ranges up to 500 miles and a payload of 10,000 lb led to the design of the Jetliner with a gross weight of about 55,000 lb and powered by four Rolls-Royce Derwent 5 engines, the object being to provide a cruising speed of not less than 400 m.p.h. at 30,000ft. Furthermore, it was to operate on runways not exceeding 5,000ft in length. The aircraft had now developed, whilst retaining the same physical dimensions, into a machine which could be powered by turbojets other than the Derwent 5 (for example, the J-33 or J-42), and with a take-off weight of about 70,000 lb, depending on the type of engine chosen; landing weight of 60,000 lb; payload of up to 13,000 lb; cruising speed of 450 m.p.h. at least, together with fuel capacity for still-air ranges up to over 2,000 miles with a practical operational range of about 1,000 miles. This had been achieved whilst retaining landing and take-off characteristics which would enable the aircraft to use runways of between 5,000 and 6,000ft.

The Jetliner had been taken into such congested airports as Chicago, New York and Washington, and had demonstrated that approach procedure, manoeuvrability and speed range were perfectly normal; that the take-off and landing runs required were equal to or better than those of current types, and that handling ability on the ground was little different from that of piston-engined aircraft. Furthermore, the effect of the efflux on runway surface and personnel was not particularly serious and only a little discretion on the part of the pilot was required in handling the throttles so as not to cause discomfort to people standing at normal distances.

Mr. Atkin felt that handling ability had been sufficiently demonstrated, and that the special problem with regard to jet transports was really the question of fuel economy, taxying, run-up and awaiting instructions to take-off. Experiments would have to be carried out to establish the degree to which it was desirable either (a) to take the aircraft out to the take-off point, or (b) to take the passengers to the take-off point. It should be possible to arrange that the engines need not be started until, say, one minute before permission to take-off was granted.

JET AIRLINERS IN SERVICE . . .

Turning to the special features of the Jetliner, the lecturer said the aircraft had a completely automatic pressurization system capable of operating under chosen conditions up to a maximum differential of 8.3 lb/sq in. This rather high pressure had been chosen for two reasons: (a) it was desirable for the passengers to have the cabin altitude as low as was practicable, and 8.3 lb/sq in provided a 4,000ft cabin at 30,000ft; (b) the importance of climbing and descending as rapidly as possible to and from the cruising height in the interests of fuel economy, whilst submitting passengers to as low an apparent rate of climb as was feasible.

The structure had to be tested to at least 16.6 lb/sq in, and this meant that the fuselage structure had to be as reliable as the wing itself. Another factor influencing the structure was the speed at which jet aircraft flew. This inevitably gave rise to special structural problems, and methods of design and construction, if the weight penalty associated with greater speed was to be minimized. In the case of the Jetliner, a structure-weight percentage (in terms of the take-off gross weight) of the order of 25 per cent spoke well for the job the engineers had done.

Referring to the power installation, Mr. Atkin said that the Jetliner employed water-methanol thrust augmentation, which provided up to 12 per cent thrust increase under hot-day conditions.

Aerodynamic features of the Jetliner which could be considered as peculiar to jet aircraft design were the unbalanced control surfaces and, whilst these could not be claimed as an advantage by comparison with other types of aircraft, they were becoming increasingly a feature of high-speed flight. In advancing the case for the jet transport, the cleanness of airflow over the airframe, unspoiled by an airscrew, was probably the main point. It gave rise to more effective control, absence of extraneous asymmetric effects, and a general smoothness over the cabin, resulting in absence of vibration and a pleasanter and generally lower noise level throughout the greater part of the cabin length. By contrast to airscrew-driven types, there was a rise in noise level toward the after-part of the cabin. However, by adequate soundproofing, this need not be higher than that which obtained in piston-engined and turboprop types. Throughout the remainder of the cabin —which was usually three-quarters of its length—the superiority of the turbojet was outstanding.

In conclusion, Mr. Atkin said that, as a result of much investigation, Avro Canada had demonstrated that the Jetliner, or any other jet transport, could be operated economically with adequate payload, and at the same time carry fuel reserves which met all normal airline requirements. The factors involved in achieving maximum fuel-economy were brought out best by evaluating operation of the aircraft in passenger-miles per year as the product of block speed and passenger capacity. If the approximation was accepted that the present-day turbojet consumed 70 per cent more fuel than the turboprop, and 160 per cent more fuel than a piston-engine, whilst the jet fuel was roughly two-thirds the cost of piston-engine fuel, then it could be seen that the cost per mile was approximately the same. In other words, the jet aircraft was competitive with the other types, while having the added advantage of increased speed and comfort.

FROM THE ENGINE MANUFACTURER'S ANGLE

FOLLOWING the papers, above, presenting the view of the operator and the aircraft manufacturer, those of the engine builders were given by Mr. B. H. Slatter, in *The Mamba Engines in the Apollo Aircraft*.

Mr. Slatter gave a brief description of the Mamba and stated that, in building it into a power unit for the Apollo, the main aims had been to keep the frontal area of the nacelle to a minimum, to group all the accessories on the engine unit, and, at the same time, to provide good accessibility. The engine was fully cowled, the maximum diameter of the cowling being 31in, and the nose cowling formed a 3½-gal oil tank. The power plant was divided into three zones by fireproof bulkheads. The engine, fuel and oil systems, and the airscrew governor and feathering pump were all located round the compressor casing, and ready access to the accessories for servicing was afforded by hinged and detachable cowlings with toggle fasteners. Drive was taken from the engine accessories casing to a bevel box in the leading edge of the wing, where the drive was bifurcated, and taken outwards to subsidiary gearboxes carrying generators, cabin blowers and hydraulic pumps. The power plant was easily detachable from the airframe by disconnection of the auxiliary drive-shaft, fuel and electrical services and removal of four mounting bolts.

Engine-control Problems

After referring briefly to the ventilation of the nacelle and touching on the fact that turbine units required higher-capacity ground-starting facilities than did piston engines—in which connection it would probably prove advantageous to employ higher voltage starting systems in order to minimize the weight of cables and connections—the lecturer dilated upon controls.

It had been necessary to decide first of all what proportion of the total power output should be given to the airscrew, and what should be left in the exhaust jet. Calculations and tests had shown that for air speeds up to 350 m.p.h. the maximum thrust-horsepower would be obtained by converting about 85 per cent of the available power into shaft horsepower for the airscrew. Unlike a jet unit with fixed propelling nozzle, the rate of fuel feed to a turboprop and the speed at which it ran were not fixed automatically by the characteristics of the engine. There was a variety of possible ways in which the engine could be controlled, but it was decided to govern speed by means of the airscrew (as in piston-engine practice), and to govern power by scheduling the fuel supply.

As the speed and power of the engine were independent, it was next necessary to choose the relationship between these variables. The power speed characteristics of a turbine were considerably less flexible than were those of a piston engine. In the lower part of the speed range, the power capabilities were limited either by the maximum temperature which the turbine materials could withstand, or by the possibility of overloading the compressor, which resulted in breakdown of the aerodynamic flow. A "working line" was thus chosen which enabled the engine to develop any given power with the minimum fuel consumption. Since the speed of the engine was governed by a v.p. airscrew, it was quite simple to arrange for the engine speed to approximate to the "working line" in flight, even when the engine power was reduced to zero. On the ground, however, it was desirable that the engine idling speed should be lower to avoid excessive idling thrust, and to keep fuel consumption low. The ground idling speed (approximately half max r.p.m.) was, in fact, the speed corresponding to the fuel flow which gave satisfactory engine starting. Between the ground and flight idling speeds, it was possible to over-fuel the engine if the throttle was opened too rapidly, and this had caused some trouble but, by the introduction of a temperature control, a satisfactory remedy was found.

There was no need to provide the pilot with separate control of speed and power; this would, in fact, be unacceptable, since there would be nothing to prevent selection of an impossible power at low speed, with consequent damage to the engine by overheating. Thus, to achieve the desired relationship, the control lever of the fuel metering unit and the airscrew governor control lever were both connected to the pilot's throttle. The connection to the airscrew governor was made through a servo system which, in effect, enabled the governor to anticipate the change in power which was being made. The high-pressure cock in the fuel system was connected to a separate lever in the cockpit which was also linked to the feathering over-ride on the airscrew governor. Thus, if the lever was operated in flight, the fuel supply was cut off and the airscrew control simultaneously over-ridden to select coarse pitch.

As the engine fuel requirement varied with throttle setting, air-intake pressure and temperature, it was obvious that a sensitive and accurate control was required to achieve the accuracy of temperature control desired at, or near, full power when the engine was operating close to the maximum allowable temperature. Furthermore, the Mamba jet-pipe temperature changed about 3 deg C for every one deg C deviation in ambient air temperature from standard.

To meet these difficulties, a fuel metering control sensitive to jet-pipe temperatures was developed. It comprised an electrical amplifier, fed with signals from thermo-couples in the jet-pipe, and from a temperature selector linked with the throttle. The output of the amplifier controlled a fuel valve. Although a magnetic amplifier had been chosen in the interests of reliability, it was not desirable to rely entirely on a somewhat complicated electrical system. Consequently, the temperature-control function was limited to about 30 per cent of the total fuel flow, so that it acted as an accurate trimmer of the operating temperature, but any failure of the temperature control could not have a catastrophic effect on the power of the engine.

Mr. Slatter then went on to give a brief description of the airscrews used on the Apollo and next discussed re-starting in flight. In some ways the turboprop was easier to start quickly in flight than was a turbojet, owing to the fact that the airscrew could be used to accelerate the engine rapidly. In effect, it was only necessary to unfeather the airscrew with fuel and ignition turned on. However, because of the relatively high inertia of a turbine engine, rapid unfeathering could result in a momentary but considerable amount of drag while the airscrew fed power into the engine to accelerate it. Furthermore, should the combustion chambers fail to light, the drag would remain as the airscrew continued to windmill the engine at high speed.

However, the reverse torque switch dealt admirably with re-starting. In effect, it controlled the rate of unfeathering the airscrew, prevented more than 50 h.p. being fed into the engine, and automatically arrested unfeathering while the blade pitch was still quite coarse, until such time as the combustion chambers lighted and the engine began to develop power.

Modifications for extra power

Mr. Slatter then told how, by increasing the maximum r.p.m. to 15,000, and altering the aspect ratio of the blading, the output of the Mamba had been lifted to 1,250 h.p., and went on to say that when the modified engines were installed in the Apollo, the jet-pipe diameters would be expanded up to the maximum size permitted by the wing spars in order to revert as far as possible to the intended distribution of power output between the airscrew and the residual jet.

Various methods of ensuring reliable operation under icing conditions had been considered, and the use of a methanol spray in the engine intake had been chosen for the Apollo. A single-spray jet was fixed to the periphery of the airscrew spinner, so that the methanol was distributed around the annular intake, the rate of flow being from 10 to 40 lb/hr, depending upon the severity of the icing. Ice formation could not occur on the leading edge of the engine cowling, as the nose cowl was the oil tank and was therefore kept warm. It was interesting to note that, although it had originally been feared that the small and relatively fragile blades of the Mamba compressor might be particularly susceptible to damage by ice, the engine had, in fact, suffered no damage under natural or artificial icing conditions in flight, even when no anti-icing protection had been provided.

In conclusion, Mr. Slatter observed that, although an engine might reach a satisfactory state of development on the test-bed, there remained problems associated with its inclusion in a suitable power plant for association with an aircraft, and with its operation in flight.

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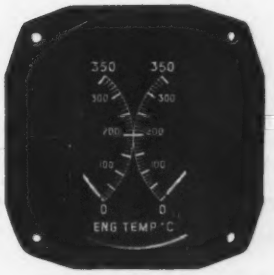

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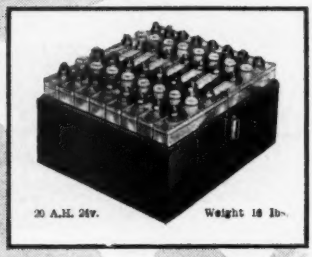

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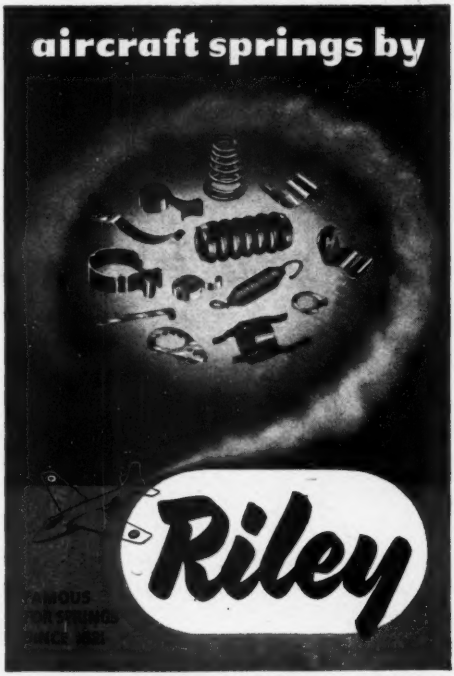

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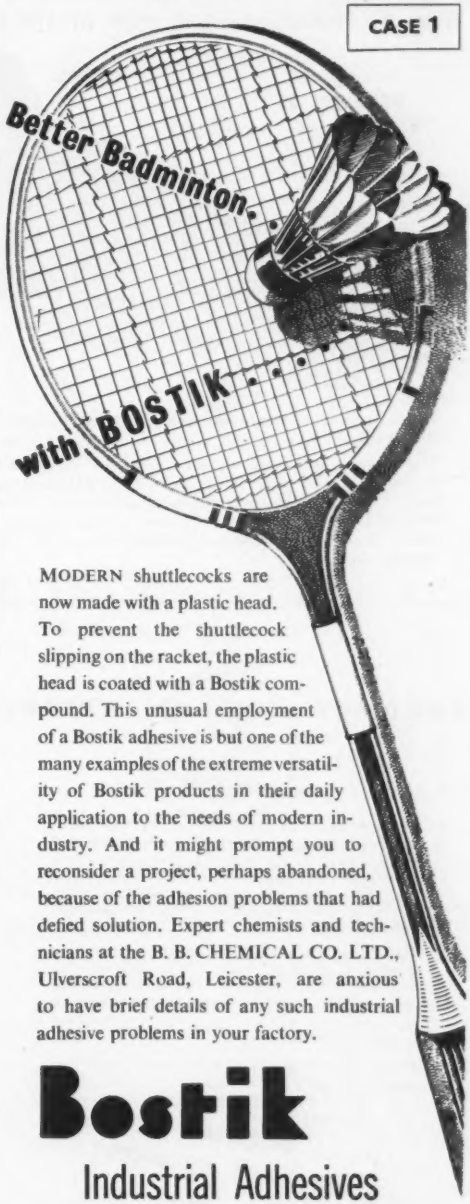

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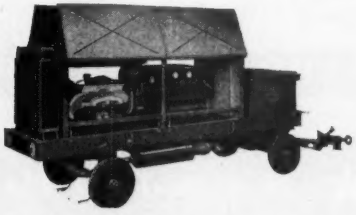

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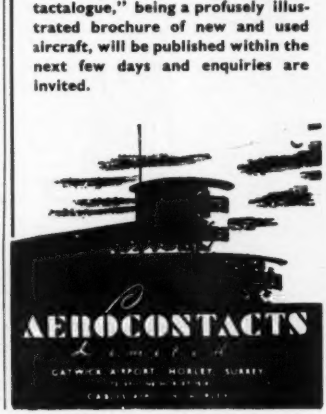

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c & d STRESS OFFICE ASSISTANTS. Minimum qualifications, mathematics degree.

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2 STRESS calculation, previous experience on aircraft structures.

e TECHNICAL ASSISTANT for weight estimating. Previous experience or as intermediate stressman essential.

PERMANENT progressive posts to keen ambitious men. Write, giving details of education, technical training and experience in previous employment, to Personnel Manager, The de Havilland Propeller, Ltd., Hatfield, Herts. Satisfactory references will be required. Travelling expenses paid to candidates selected. [6532

HANDLEY PAGE Ltd., have vacancies for:—

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APPLICATIONS, stating age, qualifications and details of experience, to: Staff Officer, Handley Page Ltd., Cricklewood, London, N.W.2. [6546

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DE HAVILLAND ENTERPRISE at Hatfield, Herts.

VACANCIES for Draughtsmen and Specification technicians as under:

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k Senior draughtsman, experience in aircraft electrical installation and details.

l Senior draughtsmen, experienced aero engines or auxiliaries, or five years light internal combustion engines.

m Senior draughtsman, 5 years' experience in aircraft drawing office for D.I.S. with full knowledge of procedure.

n Junior-intermediate draughtsmen, two to three years' drawing office experience essential.

p Specification writers, experience essential, either in similar capacity or aircraft drawing office or aircraft works technical department. Ability to write technical matter clearly in good English necessary.

q Specification writer for junior position. Opportunity for advancement for man of good education and some aero engine experience. Ex-R.A.F. man preferred.

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AIRCRAFT DEFECTS INVESTIGATOR required by de Havilland Aircraft Co., Ltd.

APPLICANTS must have had a sound practical training, some drawing office experience, and be capable of tabulating and recording the results of investigations.

THE position holds very good prospects for a man with initiative.

APPLY in writing, stating qualifications, age and approximate salary required, to Chief Draughtsman, de Havilland Aircraft Co., Ltd., Hatfield, Herts. [6506

VACANCIES exist at Blackbushe Airport for:—

LICENSED ground engineers, welder-sheet metal worker, licensed aircraft electrician.

APPLICATION to Manager, Silver City Airways, Ltd. [6559

REQUIRED for aircraft engineering development laboratory.

THE Bristol Aeroplane Company, Limited have vacancies for test assistants for general duties in connection with structural and mechanical testing, design of test rigs, test analysis, etc. Higher National Certificate and experience in this class of work desirable.

APPLICATIONS to the Personnel Manager (Aircraft Division), Filton House, Bristol. [6543

EAGLE AVIATION, Ltd., have vacancies in the following aircrew categories:

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(2) First Officers, minimum requirement Senior Commercial.
(3) Radio Officers with 1st Class Flight Telegraphists' Licence.

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GLOSTER AIRCRAFT, Co., Ltd., Vacancies exist in the Research Department for the following:—

(a) Staff to work on the test and development of aircraft hydraulics, fuel and air systems, flight testing instruments and design of special testing apparatus.

(b) Staff for testing of aircraft structures and resonance testing of complete aircraft.

PREFERENCE will be given to men with engineering degrees, but practical experience is an essential. For vacancies (a), applicants must have, as well as a sound mechanical engineering training, a knowledge of lectrical theory, elementary electronics, vibration theory and aircraft design and construction. Apply Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [6911

COMMERCIAL pilot with instrument rating for Rapide required immediately.—Apply Box 2225. [6517

WANTED, Rapide and Auster Pilots during their holiday periods. Board found. Roster being compiled.—Giro Aviation, Ltd., Southport. [6536

LICENSED aircraft radio maintenance engineer required immediately.—Please write, Chief Engineer, Eagle Aviation Limited, Luton Airport, Luton, Beds. [6911

THE DE HAVILLAND AIRCRAFT Co., Hatfield, invite applications to fill vacancies for jig and tool draughtsmen with experience of aircraft tooling, and for good GENERAL engineering draughtsmen.—Applications, giving full details of age and past experience, should be addressed to the Personnel Manager. [6497

CHARTER PILOT required, London area, with senior commercial licence (endorsed Rapides), instrument rating and R/T licence. Permanency.—Apply Box No. 2260. [6545

JIG AND TOOL DRAUGHTSMEN required. Previous aircraft experience not essential. Pension and life assurance scheme.—Apply, Employment Manager, Vickers Armstrongs, Ltd. (Aircraft Section), Weybridge. [6546

WANTED, flying instructor with G.A.P.A.N. endorsement, for the Strathtay Aero Club, Perth. Salary £700 per annum.—Apply, Airwork Limited, Perth Aerodrome, Perth. [6552

BROOKLANDS AVIATION, Ltd., have vacancies for airframe and engine fitters, electricians, and woodworkers, for servicing and repair of R.A.F. aircraft. Good wages and piecework bonus.

APPLY: No. 4 Site, Sywell, Northants. [0008

JIG and tool draughtsman required, fully experienced. —Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [0593

WANTED for Newcastle-upon-Tyne Aero Club, Municipal Airport, Newcastle-upon-Tyne, chief instructor to also undertake management of club.—Full particulars, including salary required, to Honorary Secretary. [6503

WANTED, flight engineers for York aircraft. "A" and "C" to cover York aircraft essential.—Apply: Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0610

APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, the de Havilland Engine Co., Ltd., Stonegrove, Edgware, Middx. [0675

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RADIO MECHANIC wanted for maintenance on Dakota aircraft at Northolt Airport. Apply Mr. Adams, Scottish Airlines, Northolt Airport. Telephone: Waxlow 4311, Extension 427. [6568

BRITISH MESSIER, Ltd., Cheltenham Road East, Gloucester, require an assistant in their Weights Department.—Please write, stating age, experience and salary required, to Mr. E. G. Collinson, Chief Technician. [6558

SECRETARY Shorthand Typist (male) required for confidential position in large aircraft organisation in the South.—Write, giving full particulars, to Box 4473H, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. [6551

SCHEDULE clerks required (male), with experience in compiling M.O.S. spares schedules. Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0596

TECHNICAL authors and illustrators required. Knowledge of M.O.S. procedure desirable.—Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds. [0594

GLOSTER AIRCRAFT, Co., Ltd., have vacancies for fully experienced aircraft structural and electrical draughtsmen. Applications in writing, stating age, experience and salary required, to: Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [0910

DRAUGHTSMEN, senior and junior, jig and tool and airframe, required for work on interesting and varied projects. Pension scheme. Full details of experience, etc., to Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middx., quoting Ref. DO/AI. [6455

MECHANICAL, structural or general engineering draughtsman wanted for aircraft work; pension and aircraft experience not essential; pension and life assurance scheme.—Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [6562

AERONAUTICAL or mechanical draughtsmen and stressmen required, all grades.—Apply, stating age, experience and salary required, to Alan Munts and Co., Ltd., Aircraft Section, Heston Airport, Hounslow, Middx. [0419

AIRCRAFT FITTERS are required by de Havilland Aircraft Co., Hatfield. Good working conditions. Sports Club, etc. Apply by telephone Hatfield 2345, in person or by letter addressed to Personnel Manager. [6477

GOOD intermediate Airframe Design Draughtsman required for interesting new work. Applications, in writing, stating age, experience and salary expected, to Chief Designer, Auster Aircraft Ltd., Rearsby Aerodrome, Leics. [6478

URGENTLY required for high class precision work:— Instrument fitters, assembly fitters used to fine limits, universal millers and capstan setter operators. Apply, giving full details of experience, etc., to Personnel Officer, Normalair, Limited, Yeovil, Somerset. [6526

FOLLAND AIRCRAFT, Ltd., require senior and intermediate stressmen for extremely important and most interesting work at Hamble. Write, giving age, qualifications and experience, to the Personnel Manager, Folland Aircraft, Ltd., Hamble, Hants. [0066

WELL-KNOWN manufacturers of precision aircraft instruments, situated in the West of England, have a vacancy in their expanding laboratories for a senior mechanical engineer to control design and development of a wide range of aircraft instruments and allied equipment. APPLICANTS should have a sound technical education, with previous design experience in pressure sensitive elements and indicator mechanisms. Salary scale, £750 to £1,000, depending upon age and experience.

APPLY, giving details of qualifications and experience, to Box No. 2263. [6540

ASSISTANCE in housing accommodation to selected candidate. [6560

BLACKBURN AND GENERAL AIRCRAFT, Ltd., have vacancies for senior and intermediate stressmen with good engineering training and sound knowledge of, and experience on, all-metal aircraft.—Applications, giving particulars of age, training, experience, etc., to Personnel Department, Brough, E. Yorks. [6491

FLYING INSTRUCTOR required by the de Havilland Aircraft Co., No. 1 Reserve Flying School. Minimum qualifications R.A.F. "B" category, also competent to undertake staff pilot's duties on Anson aircraft.—Apply, giving full particulars, to Personnel Manager, de Havilland Aircraft Co., Hatfield, Herts. [6504

LINK TRAINER INSTRUCTOR required by the de Havilland Aircraft Co., Ltd., for No. 1 Reserve Flying School. An ex-pilot preferred, but previous Link experience not essential.—Apply, giving full particulars, to Personnel Manager, de Havilland Aircraft Co., Hatfield. [6556

METHODS ENGINEERS. Applications are invited from engineers with experience of sheet metal details and assemblies. Applicants must have good practical knowledge of modern press shop methods.—Write, stating age and full details of previous experience, to Personnel Manager, de Havilland Aircraft Co., Hatfield. [6555

CAPABLE Secretary required, to take charge of Flying Club, preferably with wife who would supervise catering, etc. Limited living accommodation could be provided.—Write, giving full details and salary required, to Leicestershire Aero Club, Ltd., c/o 11, Cank St., Leicester. [6551

DOWTY EQUIPMENT, Ltd., Aircraft Hydraulic Engineers, Arle Court, Cheltenham, require design draughtsmen, preferably with some knowledge of hydraulic and landing gear components for aircraft. Write: Personnel Manager, giving details of training and experience, and mentioning age and salary range. [0002

MAN with initiative and experience required to work on modern aircraft electrical test installations. Applicants should hold H.N.C. and have had drawing office experience. Write, giving age, experience, salary, etc., to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, I.o.W. [6432

NAVIGATION INSTRUCTORS required for service in the North of England. Applicants should be in possession of, or in a position to obtain, a Flight Navigator's Certificate and preferably have had R.A.F. staff navigator experience. Salary scale, £700-£800 p.a. Signals Instructor for both air and ground duties. Applicants should be technically qualified and in a position to supervise radio maintenance section.—Apply, Chief Instructor, Airwork Limited, R.A.F. Station, Usworth, Castletown, Co. Durham. [6585

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A WELL-KNOWN firm in the London area requires designers and designer-draughtsmen. Suitably qualified men with internal combustion engine design experience are invited to apply for these permanent and progressive positions.—Applicants should write, giving the fullest information, mentioning Ref. CDF, to Box No. 2391. [6547]

DRAUGHTSMEN with experience in high quality light mechanical or hydraulic engineering are required by progressive Midland manufacturing company. Positions with good prospects are available to younger men. Salaries will be in accordance with age, qualifications and experience.—State details, together salary required, to Box No. 2219. [6505]

APPLICANTS are invited for position of foreman sheet metal worker for large manufacturing works in the south of England. Applicants should have had wide practical experience of stainless steel and be conversant with A.I.D. requirements. Please state full details of age, experience, etc., by letter to Box 1267, A.K. Advt., 212a Shaftesbury Avenue, London W.C.2. [6570

SAUNDERS-ROE, Ltd., invite applications from all grades of draughtsmen for employment in their aircraft drawing office at Cowes, and from junior draughtsmen for employment in their helicopter division at Eastleigh (Southampton).—Write, stating age, qualifications, experience and salary required, to the Personnel Officer, East Cowes, I.o.W. [6500

A VACANCY exists in the experimental department at Saunders-Roe, Ltd., for a good technician with experience in mechanical and structural testing. Applicants, who should have the H.N.C. or equivalent qualification, should write, stating age, salary, experience, etc., to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, I.o.W. [6431

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd. Applications are invited from senior and junior draughtsmen, and stressmen, for work on this interesting programme. Write, giving details of experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Luton, Beds. [6506

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: Designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [6420

APPLICATIONS are invited from senior and intermediate design draughtsmen; experience of aero engine design desirable but not essential. Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Star Lane, Edgware, Middlesex. [6049

DRAUGHTSMEN with experience in high quality light mechanical or hydraulic engineering are required by progressive Midland manufacturing company. Positions with good prospects are available to younger men. Salaries will be in accordance with age, qualifications and experience. State details, together with salary required to Box 2464. [6504

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HANDLEY PAGE Ltd., have vacancies for Senior and Junior Technical Assistants in the Mechanical and Structural Test Department at Radlett or Cricklewood. Qualifications should include a Degree or Higher National Certificate. Previous experience is desirable but not essential.—Write, stating age, qualifications and details of experience to: Staff Officer, Handley Page Ltd., Cricklewood, London, N.W.2. [6478

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HANDLEY PAGE (READING) Ltd., have vacancies in their design office for senior and junior draughtsmen with aircraft experience. Also required are stressmen, who should have at least two years' experience and with a degree or Higher National Certificate with endorsements in aeronautical subjects. These positions are progressive and offer excellent opportunities to the right men.—Please send full particulars to the Personnel Office, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [6901

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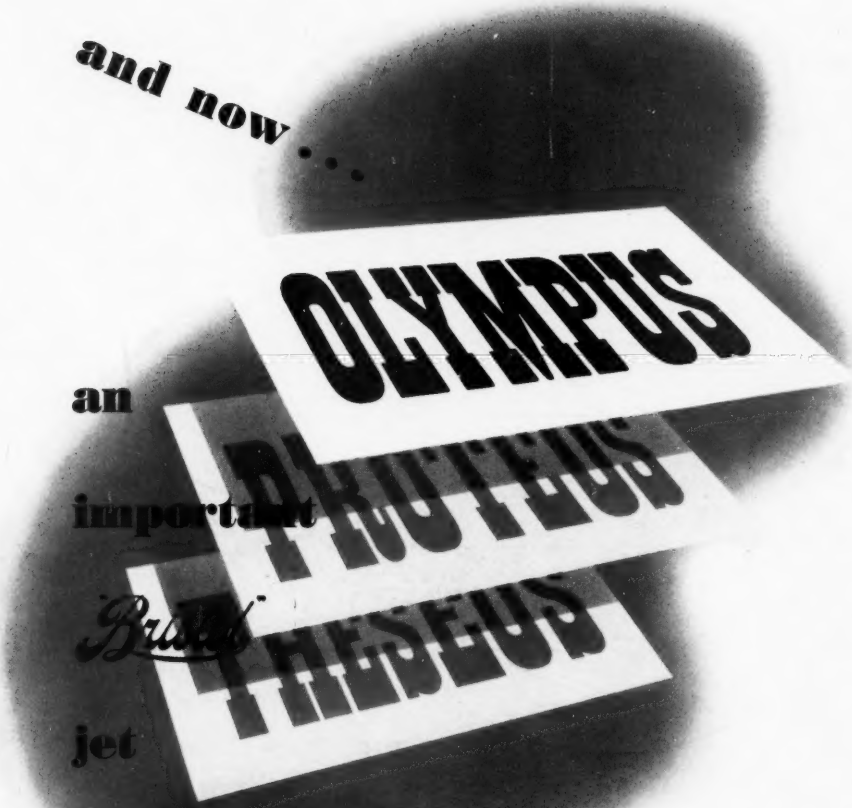

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